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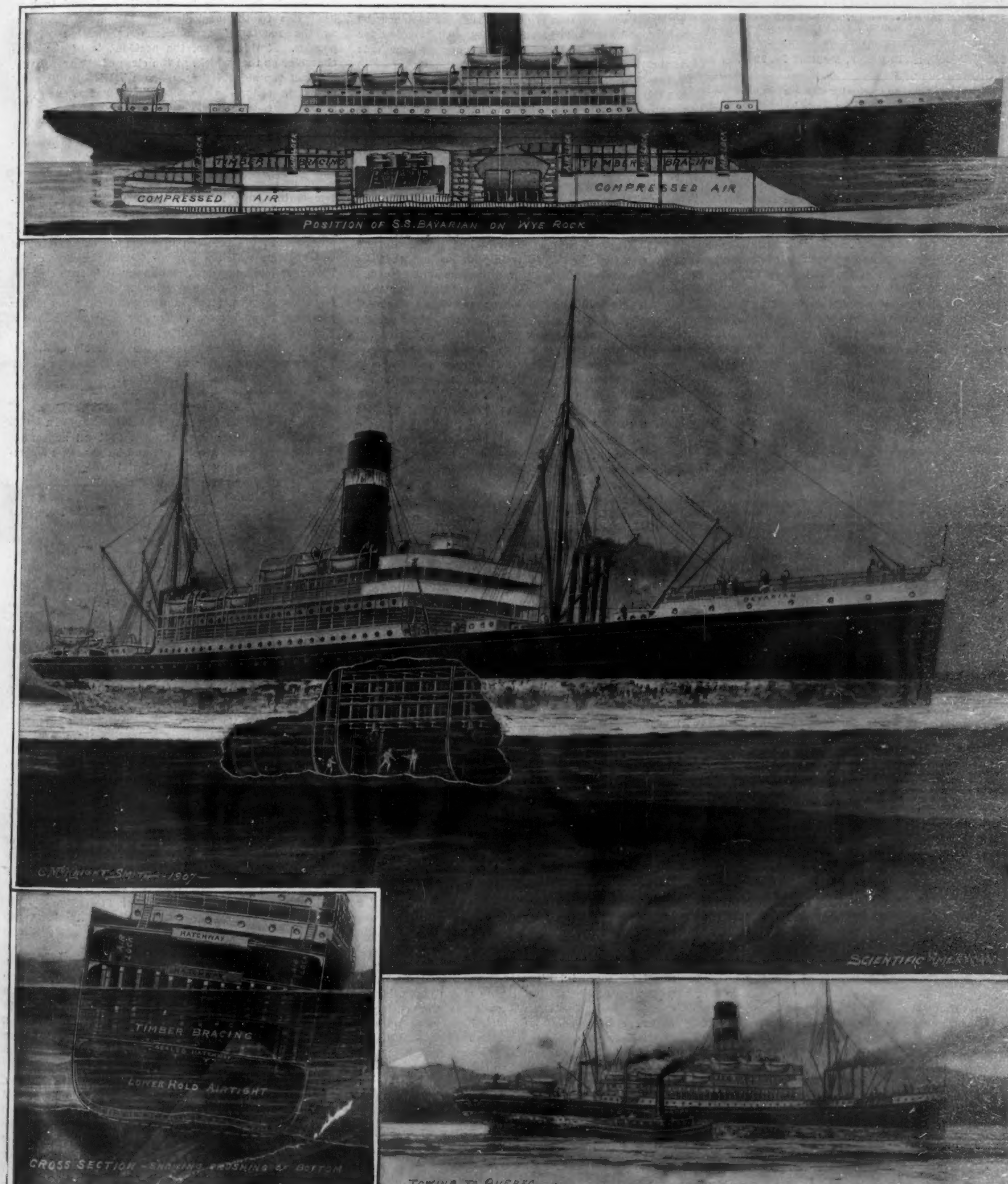

HOW THE STEAMSHIP "BAVARIAN" WAS CONVERTED INTO A HUGE STEEL AIR BUBBLE AND FLOATED AFTER SHE RAN ON WYE ROCK IN THE ST. LAWRENCE RIVER.

This Is the First Time That a Sunken Vessel Has Been Raised By Compressed Air.—[See page 250.]

SCIENTIFIC AMERICAN

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NEW YORK, SATURDAY, MARCH 23, 1907.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

ARCHITECTURAL IMPROVEMENT OF NEW YORK CITY.

The strict regard for utility which characterizes the average American has been perhaps the most potent influence in a national industrial growth which is absolutely without parallel in the history of the world. But while utility makes for a rapid increase in wealth and material power, and the development of certain of the more robust elements of national character, these elements are obtained at the cost of certain other qualities, abstract and concrete, which many of us are beginning to realize the nation can ill afford to lose. Just now we have in mind the evil effects which a too slavish obedience to the promptings of utility have had upon the appearance of the great cities, in which the more important interests of the nation are centered, and in which so large a proportion of its people must ever dwell. Thus, whatever may be said, and a great deal may be said, in favor of the rectangular system of laying out the streets of a city, on the ground of its simplicity, its economy of space, and the readiness with which it lends itself to street nomenclature and numbering, it is coming to be understood that judged from the aesthetic and architectural point of view, and even from that of convenience, it has most serious drawbacks. Why is it that the average American tourist is filled with such immediate pleasure as he looks upon the winding streets and the general unstudied grace of an ancient European city? Something broader and deeper than a mere sense of novelty enters into his appreciation; and, as a matter of fact, his pleasure is founded in his unconscious recognition of certain fundamental laws of harmony and beauty, to which the stiff uniformity of the blocks and squares of the average American city does violence.

It is a curious fact that the ground plan of most of the great cities of this country was determined in the office of the real estate speculator and drawn with a lead pencil and a common office ruler. Certain it is that when the enterprising vendor of city lots pinned his rude sketch upon his office walls, he little dreamed that, before many decades had passed, the wildest flights of his prospectus would have been surpassed, and those crudely-drawn squares covered by the towering business buildings or the sumptuous homes of a prosperous city, and its streets filled with the rush and roar of busy commercial life.

For many years past there has been a growing conviction that the time has come for taking hold of the question of the architectural and aesthetic appearance of New York city, to say nothing of the convenience of its thoroughfares to the requirements of traffic, and devising some comprehensive scheme which will improve its present appearance and make provision for its inevitable future growth. Toward the close of the year 1903 the Board of Aldermen of this city created the New York City Improvement Commission which, after an exhaustive study of the problem, presented two reports, one in 1904, and a final report in January of the present year. The Commission realized that a comprehensive plan for the city's development must necessarily anticipate the future growth of the city for many years to come, and that it must be so designed that all of its parts should be consistent and form a homogeneous whole. This co-ordination was necessary in order that any future improvements might be carried out with a definite purpose and along definite lines, and not, as has been too often the case, without reference to any general plan for the city's betterment. The framing of such a system of improvement involved not only the laying out of parks, streets and highways, the location of city buildings, the improvement of water fronts, etc., but also questions of more or less detail relating to pavements, sidewalks, appropriate house numbers, gas and electric fixtures, the manner of indicating the streets, the location of statues and monuments commemorative of historical events, the question of tree planting, and many other matters, all of essential importance if New York is to take its place as one of the great metropolitan cities of the world, not merely as regards its size and numbers, but also in respect of its aesthetic and architectural beauty and dignity.

In studying the final report, with its ambitious and really stupendous system of boulevards, parkways, and monumental structures, one must be careful to bear in mind that the enormous expenditure of time and money involved in its execution is intended to be spread out over a long series of years. To adopt the Napoleonic method, would be to throw this city, in spite of its vast resources, into immediate bankruptcy. No such course is contemplated by the committee; and the elaboration of these plans on such a mammoth scale and with such completeness, is done so that the plan may be settled at least in its broad outlines, definitely and for all time, and an end made of the haphazard methods of the past.

The salient feature of the general plan, as it affects the city as a whole, is to afford adequate and suitable avenues of connection between the different parts of each borough, as well as between the different boroughs themselves and the outlying distances. Furthermore, while each borough is provided with a park system of its own, each system is connected with the other by suitable parkways so as to make them parts of one harmonious whole and by making each supplement the other, to add largely to the beauty and advantages of all. It is largely in view of the double purpose of uniting the separate park systems and at the same time preserving their individuality in each borough, that the Commission has planned for numerous and extended parkways and comparatively small parks rather than extensive individual park areas; and the wisdom of this policy cannot be disputed. The report is accompanied by a large number of maps illustrative of the designed improvements, and while limitations of space prevent any detailed reference to these, mention should be made of the special merit attaching to the plan for connecting and treating the terminals of the new East River bridges, and notably of the plans for a great circular plaza 800 feet in diameter at the point where the Brooklyn and Manhattan bridges converge on the Brooklyn side. It is sincerely to be hoped that after due discussion of the really admirable plans here presented, the report will be adopted, and the future convenience and beautification of New York city thus definitely assured.

THE DEMAND FOR TECHNICALLY QUALIFIED YOUNG MEN.

In view of the general impression that the professions are greatly overcrowded, it is surprising to learn that some of the leading railroads of the country are finding much difficulty in securing properly qualified young men to fill subordinate positions on the engineering staff. One road in particular has recently gone so far as to make the fact known in the public press, and to invite communication from young men who have passed through technical schools, and possess the necessary qualifications to enable them to commence work as rodmen and chainmen, or do the simpler instrumental work connected with the construction and maintenance of railroads. It was further stated that the remuneration would be sufficient to enable these men to maintain themselves at once in decency and comfort, and that for those who showed aptitude and application there was a reasonable expectation of early promotion. Further evidence of the excellent opening afforded by the present industrial activity is found in the fact that, in one of the leading technical colleges of the country, every member of the graduating class of 1906 had secured an appointment some months before the close of the college year. The demand for technically-qualified men in railroad work has unquestionably been stimulated by the recognition of the fact that the increase in the capacity and weight of the motive power and rolling stock, and the demand for more intelligent supervision due to the introduction of electric traction on steam roads, is rendering it desirable that not only the engineering department, but also those which have to do with the maintenance and operation of the road should be run by men with sufficient technical knowledge, with sufficient training in natural science, to enable them to exercise a more intelligent oversight of their departments than is possible in the case of men whose theoretical knowledge is bounded by the limits of a common school education.

In this connection it is gratifying to note that there is in successful operation in this State a railway training school under the supervision of practical railroad men, in which the students are put through a course designed to prepare them specifically for employment in the various departments under which the complicated operation of our railroads is carried on. Without casting any disparagement upon the many able men who, from humble positions on our railroads, have risen to stations of great trust and responsibility, we believe that the complicated problems involved in the operation of a great modern railroad system have rendered it not only desirable but imperative that the heads of those departments which have to do with the mechanical and constructive elements of a railroad should be graduates of technical schools or members of the engineering profession. To make such a provision a general one would, after all, be merely to apply broadly a principle which, for many decades, has been followed upon the Pennsylvania Railroad system, whose late distinguished head, President Cassatt, was a civil engineer who had risen by steady gradations from rodman to president.

THE "JENA" DISASTER AND STABLE GUNPOWDERS.

In all probability the recent terrible disaster to the French battleship "Jena" will be found to have been due to the explosion of her after magazines as the result of spontaneous combustion of the powder. If this be so, the accident is of the same character as that which, at the close of the recent war, tore out the side of the Japanese battleship "Mikasa" at a time when, like the "Jena," she was at one of the government dockyards.

In spite of the really remarkable progress which has been made in the development of modern powders, the best of them are liable, under certain conditions, to a decomposition which, if it proceeds to a certain point and be accompanied by certain conditions of temperature, may result in the explosion of the magazine and the loss of the ship or arsenal, as the case may be. Our modern smokeless powders, when in storage, are the occasion of a degree of anxiety and watchfulness which was never felt in the days of the brown or black powders. Although it is true that the stability of smokeless powder made on the latest formulas shows a great improvement over the earlier powders, it still remains for someone to produce a slow-burning powder which, without any sacrifice of ballistic power, shall possess the desirable quality of being absolutely stable under any conditions of climate and for any period of storage.

COHESIVE FIREPROOF TILE CONSTRUCTION.

The elimination of the fire hazard in modern buildings is based upon the principle that all supporting iron or steel girders, columns, and beams must be protected from fire by some material which is a poor conductor of heat and not easily disintegrated or injured by high temperatures. Burned clay materials, such as flat, hollow, porous, and semi-porous terra-cotta blocks, and certain grades of burned bricks, are commonly employed for this purpose. Owing to the relative lightness of these materials and their high fire-resisting qualities, most steel frameworks of our large buildings are incased in hollow or flat terra-cotta tiles laid in cement mortar. Many of these clay tiles and blocks are burned in the making to 2,000—2,500 deg., so that in any fire they will not crumble or crack at a temperature below that to which they were originally subjected.

No great stress is imposed upon the hollow porous blocks used for fireproofing beams, girders, and columns, and their crushing strength is not very great. Their function is performed in protecting the steel work from an excessive interior temperature, while the metal carries the loads of the different floors. The use of hard, flat terra-cotta tiles for certain construction purposes, both to carry the load and to resist any interior fire, has in the last year or two assumed an important development. Modern methods of burning and making the terra-cotta tiles have greatly improved their strength and durability, and the better grades of them have been used in a number of buildings in New York city and elsewhere which fully illustrate the new method of cohesive fireproof tile construction.

In the new custom house in New York city the large dome surmounting the great interior rotunda is constructed entirely of fireproof flat tiles, and the total absence of any metal for supporting this huge elliptical dome shows the great cohesive power of hard, flat tiles when properly laid up in cement mortar. The dome is 80 by 135 feet in size, and supports on its summit a huge skylight of glass and metal whose total weight is 140 tons. The tiles used for this purpose are 12 inches in length, 6 inches in width, and about 1 inch in thickness. They are laid on edge, and form a perfect curve.

The masonry walls of this rotunda are built of brick up to the lower part of the dome. A massive flat ring of steel is fitted on the top of this masonry and imbedded in it, and from this the dome springs. The foundations of the dome are of solid, flat tiles cemented together on their edges, but after a few courses an outer and inner shell is formed. Nine layers of 1-inch flat tiles form the lower courses, but as the curvature of the dome is reached one course after another is omitted until near the middle there are only three layers of tiles for each shell leaving an open space between them.

A central mid-rib composed of tiles laid flat runs around the dome to strengthen it, and similar ribs of

tiles laid flat radiate from the apex of the dome to the foundations. These ribs are joined to the central midrib by cement, and all are inclosed by the two shells of the tiles laid on edge. The cohesive strength of tile construction is thus amply demonstrated. Engineers representing a number of structural steel manufacturers intimated before the work was undertaken that it was impossible to build the dome in this way without metal reinforcements of some kind; but the dome has been finished for some months and the heavy skylight placed in position. The lightness of the tiles makes the dome nearly half the weight of another of similar size constructed of metal, while the fireproof quality of the material insures the dome from interior destruction by fire. The tiles having been burned in the making do not warp or shrink after being placed in position, and elaborate decorations can be made directly to them without danger from cracking or warping.

A similar dome of less size and ambition has been built on the new Madison Square Presbyterian Church, which recently has been completed. The same size flat tiles are used there, and the dome is built and surmounted by a small tower. The crushing strength of the tiles is upward of 2,000 pounds to the square inch, and their cohesive strength is dependent chiefly upon the quality of the Portland cement used in building the dome. The major axis of this new dome is only 52 feet, but its shape and artistic appearance from either the inside or outside make it remarkable quite as much as the decorations placed on it by the architect. The dome springs direct from the walls of brick, and it thus completes a remarkable building independent of any iron or steel work.

Within the past few years a number of other similar domes of this same general character have been completed. In the new library building of the University of New York there is one with a major axis of 70 feet, and over the rotunda of the University of Virginia the Guastavino dome of flat fireproof tiles laid edgewise has a diameter of 69 feet. The Hall of Sciences, in Brooklyn, has a dome of flat tiles without any metal supporting work of 60 feet in diameter, and the new Minnesota State Capitol one of similar dimensions. The dome over the Bank of Montreal building is 72 feet in diameter, and is the largest, next to the new one over the rotunda of the New York custom house, yet finished by this new method of cohesive construction.

The construction of such fireproof, non-metal-supported domes represents a special branch of masonry designing which has slowly reached perfection in this country. It is based upon the principles of the early Roman architects who used heavy bricks and stones for their work, but with superior tiles and cement mortar to work with, the modern designers have secured strength and rigidity with materials much lighter and absolutely fireproof in character.

The high degree of skill and mathematical designing required to construct domes, arches, and stairways of tiles by the cohesive system is probably even better illustrated in the two pairs of stairs built in the new custom house facing Bowling Green in New York. These stairs spring from the basement of the building and terminate at the roof. No metal whatever is employed for supporting them. On the contrary, heavy balustrades of metal, and equally heavy marble treads, only add to the dead load carried by the tiles. Rather larger tiles are used for the stairs than for the dome construction, but they are all light and apparently frail for this work. From the basement to the main floor a circular wall of brick masonry is built, and the tiles are attached at one end to this wall; but each semi-circular flight depends for its strength and rigidity upon the cohesive strength of the tiles and the scientific strength of a curve when the load is so distributed that the pressure to the arch is continuous. Above the main floor each flight springs to the floor above without any support other than that derived from the top and bottom. The stairs are formed by a number of thicknesses of flat tiles at the base which gradually diminish toward the middle of the arch, and then thicken again toward the top.

The construction of spiral and semi-circular stairways with hard flat tiles requires independent and careful study of each individual case. No definite rule or principles can be laid down to apply to all cases, but each problem has to be worked out by itself. The combination of the spring of the arch with the continuous curve under each platform to adjust the adjoining flight are questions of mechanical skill. Such stairways of hard, fireproof clay tiles are constructed to carry loads which will suffice for any kind of public buildings, and those recently constructed in the custom house (or rather in the course of construction at this writing) are designed to carry heavy marble treads and ornamental iron and bronze work besides the weight of those who will constantly use them for ascending and descending. The fireproof quality of such stairs is of particular force in view of the modern effort being made to eliminate everything possible from public buildings which will crumble or disintegrate when attacked by a hot interior fire. The difficulty of protecting an iron stairway by terra-cotta casing as commonly practised in protecting beams and girders is quite apparent. If left unprotected a sharp interior fire will cause a collapse of the stairs and greatly increase the damage to the building. A tile stairway on the contrary would not be affected by a fire unless the temperature reached 2,000 and more degrees, and a collapse would not follow.

The use of the cohesive tile construction for floors and ceilings is well illustrated in two other notable buildings recently built in New York. The domic ceiling of the new Tiffany building is constructed of hard, flat tiles laid on edge and sprung from rotunda columns and terminating in a large skylight. In these domic ceilings the curve is less than in the domes, and the effect is of a slightly arched ceiling of great beauty. The decorations are sometimes laid directly on the tiles and in other cases ornamental faced tiles are cemented to the hard supporting tiles for interior effect. In the new Gorham building all of the different floors and ceilings are made of hard tiles. A series of arches spring from the steel columns and terminate in points in the ceiling. The compression on the tiles is uniform, so that the load is carried without any undue stress upon any part. The tiles are laid on edge, with several courses forming the arch, breaking joints at each course, and cemented together with the best Portland cement mortar. The decorations are either made directly on these fireproof tiles or ornamental tiles cemented to them. No metal work is employed to support the domic ceilings other than the series of steel columns from which the arches spring. No steel reinforcements or tension rods whatever are employed in the construction. The remarkable lightness of the floors and ceilings built in this way is one of the chief virtues ascribed to the new method of fireproof building. The carrying capacity of a floor built of cohesive tile masonry is certainly sufficient to warrant their construction in some of the finest public and commercial buildings of the country. As an interesting development of the fireproof question cohesive tile construction is without a peer, and its adaptation to new work and fields is a matter that should be of inestimable value to the building trades. In cases where lightness of structure is an important consideration hard flat tiles may prove far more desirable than iron skeleton work, and also where it is desirable to use fireproof clay materials owing to the difficulty of covering the iron work with terra cotta.

INTERNATIONAL MARITIME EXPOSITION COMMEMORATING ANNIVERSARY OF STEAM NAVIGATION IN BORDEAUX, FRANCE.

BY CHARLES A. SIDMAN.

That great interest is being manifested in the International Maritime Exposition which is to be held in Bordeaux in May is evidenced by the great progress that has been made in the construction of the several buildings, and the fact that the contractors promise to have them all ready some time before the opening on May 1.

This exposition is designed to commemorate the centennial anniversary of the successful application of steam to navigation by Robert Fulton. The motive for the celebration of this great event may be found in the fact that in 1803—four years before his success on the Hudson with the "Clermont"—Fulton made his initial trials in steam navigation in France. Fulton's experiments appear to have been at first with a submarine boat, which he christened the "Nautilus," and in which he was submerged for five consecutive hours on one occasion in 1801. This demonstration appears to have been at Brest, in the presence of the French Admiral Villaret, and it is recorded that by the use of torpedoes Fulton managed to blow up a boat in the harbor.

He made a second submarine boat, and gave a demonstration on the river Seine at Paris, on which a commission appointed by Napoleon reported favorably. Nothing, however, came of the submarine boat, and it was subsequently, in 1803, that Fulton treated the Parisians to the spectacle of a small boat propelled by steam on the river Seine with two bateaux tied astern. A chronicler of that time describes it as "un bateau mû par des roues comme un chariot" (a boat moved by wheels like a chariot).

The exposition, as officially stated, is to be international in character, and to illustrate the history of navigation. The world's marvelous progress in the art of shipbuilding and the science of navigation is to be shown by a collection of models of every kind of water craft, ancient and modern. All that pertains to ocean geography and all industrial and artistic products having relation to maritime affairs are to find a prominent place. There is to be a congress of naval architects, with lectures on science, art, industry, commerce, and political and social economy. There will be boat races on the river Garonne, in which the management hopes that crews from the several nations will compete.

The grand palace and the main buildings, covering an area of about ten acres, are all so connected by arcades that they form practically one great building. The grand palace is to be devoted to the illustration of maritime history, ocean geography, ancient and modern painting, sculpture, architecture, and horticulture. Materials for the construction of boats and ships, diving and life-saving apparatus, fishing appliances, ship's provisions, sea food, and motor machines (land and water) will have considerable space devoted to their exposition. In the place allotted to the navy there is to be a special exhibit of submarine boats, guns, torpedoes, ship's armor and equipment. Aeronautics, electrical apparatus, signals, wireless telegraphy, telephones, pumps, refrigerating apparatus, heating and ventilating appliances, port and harbor works, sea and river sports, art bronzes, lace tissues, linen and tapestry, glassware, china, cutlery, and musical instruments are also to have spaces devoted to them.

This exposition should afford excellent opportunities for American manufacturers to show the superiority of their products and extend their trade. Manufacturers of motor boats, light motors and dynamos, canoes, lifeboats, diving and life-saving appliances, fishing apparatus, optical and nautical instruments, or those who make anything that relates to navigation or ships, will find a good chance here to advertise their goods and increase their business.

An appropriation of $15,000 was made at the recent session of Congress to enable the government of the United States to be properly represented at the exposition. There will be a pavilion erected especially for the American exhibitors.

The Secretary of the Navy has ordered several of our finest warships to attend, and the members of the American Committee of Honor comprise men well versed in these matters.

It is especially fitting therefore that France in taking the initiative shows once more her thankfulness to the artisans of progress, and her sincere friendship for the United States, in commemorating the century anniversary of Robert Fulton's victory, for it was in France that a great many of his experiments were made.

BURCHELL'S ZEBRA.

One of the larger South African mammals now verging on extinction, if, indeed, it has not already ceased to exist, is the typical race of Burchell's zebra, the bontequagga of the Boers, and the *Equus burchelli typicus* of zoologists, writes Mr. Lydekker in Knowledge. This race apparently inhabited the plains to the north of the Vaal River, now forming British Bechuanaland. It is characterized by the complete absence of barring on the legs and of stripes on the lower part of the hindquarters; while between the dark brown body-stripes were faint "shadow-stripes" on the still paler ground-color. The original specimen in the British Museum brought home by the great African traveler, Dr. Burchell, was, unfortunately, destroyed at a time when but little attention was paid to the priceless value of "types," and there is now no example of this race of the species in the national collection. According, however, to a paper published by Mr. R. I. Pocock in the Annals and Magazine of Natural History for 1897, there is, however, one specimen in the museum at Tring, and a second in the Bristol Museum, both of which come very close to the typical form, although neither is exactly similar, and each differs slightly from the other. In these circumstances it is interesting to learn that a specimen exists in the American Museum of Natural History.

THE CURRENT SUPPLEMENT.

The current SUPPLEMENT, No. 1629, opens with an excellent article by the English correspondent of the SCIENTIFIC AMERICAN. This is one of the most important undertakings in connection with the development of transportation facilities in the African continent, and second in magnitude and character to the Cape to Cairo Railroad only. Many illustrations accompany the article. Poulsen's system of radiotelegraphy by continuous electrical oscillations is described. John B. C. Kershaw writes on the development of the electrochemical and electro-metallurgical industries in 1906. A very excellent discussion of the recent accident on the electrified portion of the New York Central Railroad is published, and helpful diagrams are printed, which give one a very clear idea of the cause of the catastrophe. The limits of thermal efficiency in internal-combustion engines are discussed. Dr. D. T. MacDougal presents a thoughtful article on the hybridization of the oaks. Dr. Charles Mercier contributes a very curious paper on the fear of open and closed spaces.

The Jiji Shimpo states that, according to the government's present plans, the efficiency of the Japanese navy in 1915 will be double what it was before the Russo-Japanese war.

AN ALCOHOL-ACETYLENE MIXTURE FOR INTERNAL-COMBUSTION ENGINES.

The photographs which we reproduce show an experimental testing plant for making all kinds of tests with a gasoline engine. The plant is that of Joseph Tracy, the well-known automobile driver. Mr. Tracy is also consulting engineer for several automobile companies, and in this capacity it is often necessary for him to make tests of various sorts.

As can be seen in the larger photograph, this testing plant is of the simplest possible type. It consists of a single-cylinder, 3½-horse-power de Dion motor, *M*, direct connected to a dynamo, *D*, to the other end of the shaft of which is connected a centrifugal water-circulating pump, *H*. The water pump forces the cooling water through the water jacket of the motor and also through the radiator, *W*. An electric fan is used to create a draft of air upon this radiator, if necessary, in making tests, while the temperature of the water when it enters the radiator at the bottom, and when it leaves it at the top, is shown upon two thermometers, *T* and *T'*. Attached to the outer field magnet casing of the dynamo is a circular ring having an arm, *O*, from the end of which is suspended a scale pan, *L*. The magnetic reaction of the armature upon the field magnets is counterbalanced by weights put in the scale pan, and thus the foot-pounds of energy per minute developed by the engine can be directly obtained at any moment provided the revolutions per minute are known. These are obtained from a suitable tachometer. This device does away with the inconveniences of the Prony brake, and also makes it possible to calculate the horse-power in two ways, one electrical, and the other mechanical. If the efficiency of the dynamo is known, by reading the volt and ammeters *A A'*, the electrical horse-power developed by the dynamo can quickly be figured.

The taking of indicator diagrams of a gas engine is found to be very valuable, and there are a number of different manographs on the market for this purpose. The one employed in the present instance is known as the Schultze manograph, and is shown at *S* in the two photographs. The diagram is traced by a beam of light reflected upon a ground glass by a mirror, which oscillates at the same time on both a vertical and horizontal axis. This diagram is shown in the larger photograph. A small Nernst lamp supplies the light to the manograph, and as this type of lamp requires alternating current, the latter is generated by means of a magneto, *m'*, driven by the small direct-current dynamo, *m*, and connected in circuit with the lamp, *N*, through a rheostat, *F'*. The movement of the mirror upon its vertical axis (which traces the horizontal line) is obtained from the 2-to-1 camshaft by means of the bevel-gear-driven rods, *R R'*. These rods make the same number of revolutions per minute as does the crankshaft, and they cause the mirror to oscillate by means of a suitable cam. The oscillation of the mirror upon its horizontal axis is obtained by means of the impulses of the gases upon a diaphragm in the box, *d*. The hot gases pass directly from the combustion chamber up through a small tube, which is fitted with a water jacket, *E*, for the purpose of cooling them somewhat. The impulses given the diaphragm cause the mirror to reflect the beam of light in a vertical direction, thus indicating the pressure obtained in the cylinder at any given part of the stroke. This instrument makes it possible to see indicated the variations in pressure from any cause whatever, and it is a most valuable appurtenance for the proper testing of any type of internal-combustion engine. A complete description of it will be found in the current SUPPLEMENT.

The apparatus shown in the upper photograph was constructed for the purpose of experimenting with a new system, whereby a mixture of acetylene gas and alcohol vapor is produced and used in the engine.

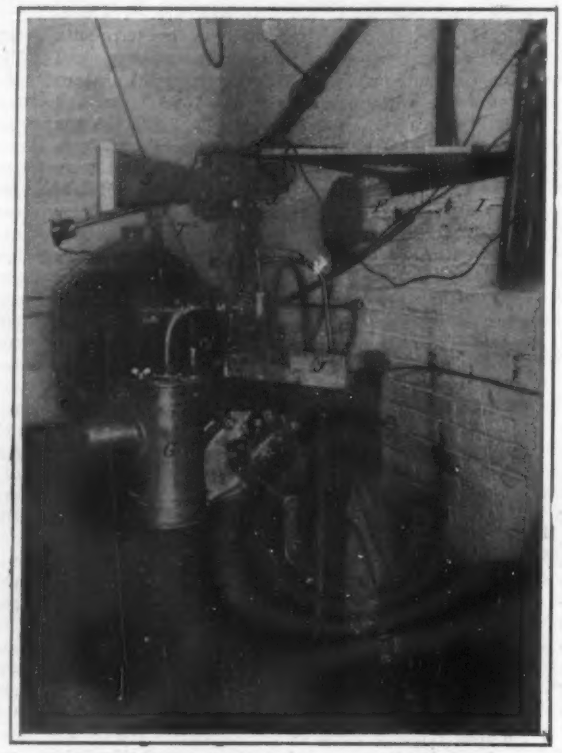
By the addition of a certain proportion of acetylene to the alcohol vapor, a quicker burning, more explosive mixture results. This would tend to make it possible to obtain from a given size of gasoline engine the same horse-power when operating with alcohol as when gasoline is used, without the greatly increased consumption (nearly double by volume) that ordinarily occurs when this is attempted. The apparatus illustrated was constructed in order to demonstrate for the inventors, Messrs. Frederick W. Barker and Thomas L. White, the feasibility of their patented process of gas generation, and to obtain interesting data as to the economy, if any, of the system. Quantitative experiments to find out the consumption per horse-power hour of alcohol, water, and carbide have not as yet been made; nor has the mixture of gases that enters the cylinder been analyzed; but the investigations carried on thus far have shown that as much as 20 per cent of the alcohol can be replaced by water with good effect. Probably not more than 50 or 60 per cent of the water in the alcohol acts on the carbide, which is detrimental, as the remainder, on account of its high latent heat of vaporization, deducts a considerable number of heat units from the mixture. The water that attacks the carbide, on the other hand, by generating acetylene increases the number of heat units quite materially. As this gas will develop twice as much power per unit of volume as will ordinary illuminating gas, one can readily see that this must be the case. The mixture of alcohol vapor and acetylene obtained in the engine cylinder should contain some 35 per cent more heat units than the alcohol and water vapor would otherwise have, this increase being based on the supposition than only half of the water in the alcohol acts on the carbide. The inventors believe, however, that the chief use of the acetylene is its action as a detonator. Being very explosive, it sets off the charge of alcohol vapor throughout almost instantaneously, and by thus hastening the combustion, causes the production of a higher mean effective pressure.

The arrangement of the apparatus, as well as its construction, can be seen from the photographs and diagram. The carbureter, *C*, is of the ordinary type; it is used in conjunction with an acetylene generator, *G*. The air intake pipe, *c*, of the carbureter starts from the inside of a hot-air jacket, *J*, which is built around the exhaust pipe, *c*. The suction pipe in the carbureter is connected with the top of the generator at one side, and contains a small auxiliary air valve, *V*, with which the richness of the gas can be varied. The inlet pipe to the motor comes up through the center of the generator and has in it a diaphragm, *D*, of wire gauze, for the purpose of checking any flame in case of a back-fire. This pipe also has a small auxiliary air valve, *D'*, that can be used in experimenting if necessary. The generator is fitted with a plug that will readily blow out in case of any back pressure from the motor, *M*. The following description with reference to the diagram will perhaps make the apparatus more clear to the reader.

The air inlet pipe, *B*, starts from a hot-air jacket, *A*, placed around the exhaust pipe of the engine. The gas pipe, *C*, leads from the carbureter into the large mixing chamber, *D*, in which a layer of ¼-inch carbide an inch thick is spread on a wire gauze screen. The mixture of water and alcohol vapor passes down through the carbide and up and out through the central pipe, *D*, leading to the engine and in which a wire gauze screen is placed to prevent back-firing. Should a back-fire occur, the pressure would blow out the plug in the side of the generator. The lime from the carbide collects in a chamber at the bottom of the generator. A pool of alcohol about two inches in depth absorbs all the particles of waste material.

Fresh carbide can be inserted through the hole in the top cover without stopping the motor. In starting, a little of the alcohol is poured on the carbide, whereupon sufficient gas is generated to enable the motor to be started without much difficulty. The cards taken from the 3½-horse-power de Dion engine by means of a Schultze manograph showed a high initial pressure (about 240 pounds) and very good expansion.

After making the preliminary tests described, the inventors expect to construct a larger apparatus and to test the same in a practical manner upon an automobile.



Testing Apparatus for Barker-White System, Showing Jacket Around Exhaust Pipe, Large Carbide Chamber, and Manograph With Engine Connections.

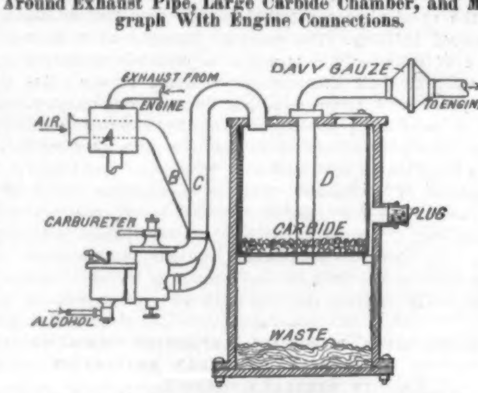
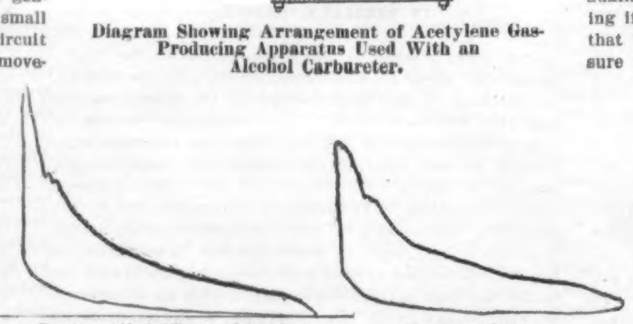
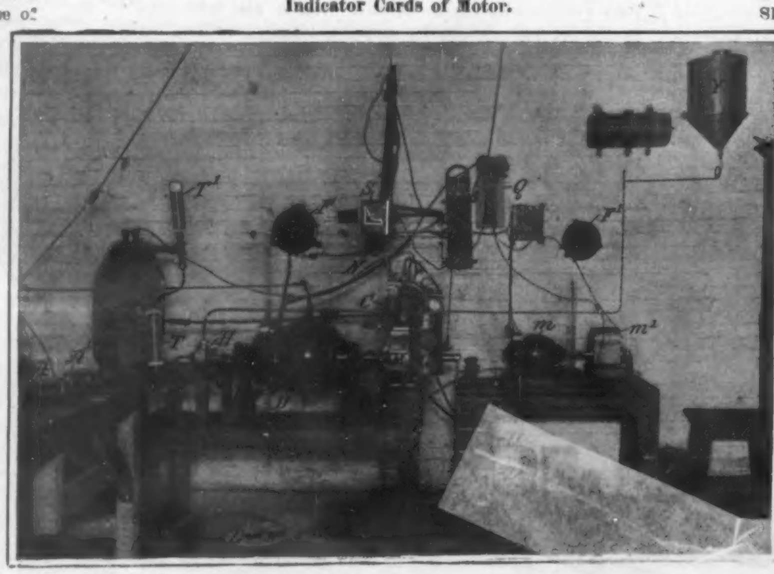


Diagram Showing Arrangement of Acetylene Gas-Producing Apparatus Used With an Alcohol Carbureter.



Indicator Cards of Motor.



Experimental Testing Plant for Internal Combustion Engines.

AA', Voltmeter and ammeter. C, Alcohol carbureter. D, Dynamo mounted on ball bearings and direct connected to engine. FF', Rheostats for dynamo and magneto. G, Acetylene generator. H, Water circulating pump. I, Mercury vacuum gage. K, Cutout and rheostat for small electric motor, *m*. K', Switch. L, Scale pan. M, 3½ h. p. de Dion gasoline motor. *m*, *m'*, Small electric motor driving magneto to produce alternating current for Nernst lamp. N, Nernst lamp of Schultze manograph. O, Lever arm attached to dynamo, D. Q, Switch and resistance for Nernst lamp. S, Ground glass screen of manograph. TT', Thermometers for testing water. U, Spark coil. W, Radiator, Y, Fuel tank. Z, Ignition battery.

The life of the mercury arc lamp in some cases amounts to 3,000 hours and m[illegible]. The conducting material of the anode is either mercury alone, graphite and iron, or nickel.

LATEST DESIGNS OF THE MOTOR IN WARFARE.

BY W. G. FITZ-GERALD.

There is little doubt that armored motor-cars will play a prominent part in the next great war, not only for purposes of transport, but also as engines of offense. Practically every military nation to-day has its own type of war-car, all of them heavily armored, and some with revolving turrets carrying quick-firing machine guns with bullet-proof shields, and capable of a speed ranging from thirty-five to forty miles an hour. On each of the Franco-German frontiers, where the greatest military forces in the world are massed, there are regular batteries of war-cars, and all of them take part in the elaborate periodical maneuvers, which tend more and more to reproduce the actual conditions of real warfare. In fact, so valuable has the motor car been found by military authorities, that a special Automobile Section of the British Volunteers has been formed out of a number of rich men, each owning a car which he agrees to hold in readiness for the use of the military, should occasion arise.

The Simms Armored Car Provided with an Apron of Steel and Ram Fore and Aft.

The Ivel First Aid Motor, an Armored Car for the Transport of Wounded Soldiers.

France, the home of the motor from the beginning, can count in time of war on at least 10,000 cars, in addition to many hundreds of motor wagons and trucks for heavy transport work and the haulage of guns. The motor-mitrailleuse, as the war-car of France is called, vies with similar vehicles already adopted in the German, Italian, Austrian, Russian, and British armies. While all other motor vehicles in time of war will rely, like the light cruisers of our navies, on their high speed for escape, these powerful war-cars grimly remain behind and fight. Some of them carry revolving turrets mounting guns of quite large caliber. The engines are often of the 45-horse-power Mercedes type, and the cars are so geared that they can travel over incredibly rough ground and negotiate very severe gradients. They are, in fact, miniature traveling fortresses entirely proof against rifle-fire, and capable of high speed. Thus their great destructive force, combined with their mobility, bids fair to introduce an entirely new element into the warfare of the future; and it is believed in many of the war offices of the world that these are merely forerunners of veritable land "Dreadnoughts," capable of destroying entire cities that lie in their track.

The French car is much faster though less heavily armed than the latest German type. Another interesting point about the well-known C. G. V. motor mitrailleuse is that it carries a kind of telescopic bridge, enabling it to cross comparatively deep ditches in its path, and even smaller streams. Possibly the most popular British type is the war-car invented by Mr. Frederick R. Simms and built by Messrs. Vickers, Sons & Maxim. This consists of a car surrounded with a crinoline of bullet-proof armor, flattened at the sides and having a ram fore and aft.

The car is about 30 feet long, weighs over six tons, and is propelled by a 20-horse-power, four-cylinder petrol engine. Its speed is up to fifteen miles an hour, and its armament two of the well-known "pompoms," which did such deadly service in the Boer war, and two automatic quick-firers. This car is intended for coast defense. It carries fuel for a run of no less than 500 miles, and above 10,000 rounds of ammunition. As an invading enemy will naturally not venture near a powerfully-armed fortress, it would certainly seem desirable to take the fortress to the enemy. The car supports a maximum load of 12 tons, and its Daimler engine is fitted with the Simms-Bosch magneto-electric ignition and timing gear.

It is capable of climbing a gradient of 1 in 7½. It carries searchlights, rope ladders, and a crew of twenty specially trained men. Another highly interesting British war-car is that provided by the London, Brighton and South Coast Railroad, whose servants form the crew and are also members of the First Sussex Artillery Volunteers. This is a kind of armored freight-car for coast defense, and it carries no less a weapon than a 40-pounder gun, mounted on a turntable in such a way that it can be fired in any direction. Lord Charles Beresford himself inspected and fired the weapon, and described the car as quite a formidable fortress on wheels. During the recent September maneuvers, the German Emperor expressed himself delighted with the powerful cars of his engineers, and watched with great interest their cross-country runs, which included very steep, grassy slopes which it looked madness to attempt. Some of the cars were fitted with "walking" wheels—that is to say, instead of a continuous tire, there were a series of circular disks or pads, which gave the entire machine an astonishingly powerful grip on the wildest and most rugged country which could possibly be traversed.

The maneuvers with these new German war-cars were of a highly realistic kind—as is always the case when the Emperor himself is present. There were dozens of weird-looking wheeled fortresses which pursued one another up hill and down dale, maneuvering for advantageous positions like powerful cruisers in a fair seaway. They circled round one another in intricate convolutions, changing speeds and belching forth what appeared to be terrific hails of lead. Unfortunately, there were several serious accidents, though these could hardly be ascribed to defects in the mechanisms of any of the cars. It is noteworthy, when considering these armored war-cars, to bear in mind that the earlier types were merely tentative efforts; and as their practical value is demonstrated, they tend

An English Armored Car Intended for Operation on Railway Lines.

A New Type of War Automobile Which Can be Used Against Airships.

LATEST DESIGNS OF THE MOTOR IN WARFARE.

like battleships to grow larger, faster, and with more powerful armaments. It seems likely that in the near future the once-dreaded war chariots of antiquity will be revived on a colossal scale. But their weapons of offense will be not merely a few sickles attached to the wheels, but rather a battery of modern guns of terrific power, securely intrenched behind impregnable walls of nickel steel, the entire fearsome fortress being capable of propulsion at the speed of an express train across all but the wildest and most rugged country.

The Germans are already beginning to construct the most ambitious of war-cars as to size and armament, and their evolutions in the field are now largely directed by the war-balloons of the Engineers.

Ehrhardt, of Düsseldorf, has recently exhibited an interesting war automobile at the International Automobile Show held at Berlin.

The war automobile is driven by a 50 to 60-horsepower, four-cylinder gasoline motor, corresponding in the main with the usual Ehrhardt-Decauville construction. The 5-cm. (1.9-inch) quick-firing gun is free to rotate around a support bolted to the frame of the car, on which it is located; it is displaced extremely quickly and readily both in a vertical and horizontal direction, so that it can be directed against military balloons and airships.

The gun is entirely surrounded by an armored casing of nickel steel plate 3.5 mm. (0.137 in.) in thickness, which protects the car driver and crew.

All devices for operating and guiding the car as well as for serving and training the gun are arranged inside the armor. For blocking the car there have been provided, inside the armor casing, four substantial spindles which at a moment's notice are lowered from inside in order to be screwed fast, thus unloading the springs and obtaining a rigid support for the guns. The ammunition stored inside the armature is sufficient for 100 rounds. The weight of the vehicle, inclusive of a staff of five men, is 7,040 pounds. On smooth roads the automobile attains a speed of 29 miles per hour. Forest paths of a gradient of up to 20 per cent are readily traversed.

HOW COMPRESSED AIR RAISED A SUNKEN SHIP. THE REMARKABLE SALVING OF THE STEAMSHIP "BAVARIAN."

To turn a 12,000-ton steamship into a huge steel bubble by pumping her full of compressed air is a recent engineering feat.

The steamship "Bavarian," of the Allan Line, ran on Wye Rock, thirty-eight miles below Quebec, on the night of November 3, 1905, a few minutes before high tide. Almost every method known to wreckers for salving the vessel was tried and found wanting and over $150,000 was spent in these efforts.

Examination had shown that the "Bavarian's" bottom amidships was in a very ragged condition. The holes were so large that it would be hopeless to try to pump the water out. Preparations were accordingly made to treat the holds as caissons, compressed air being used to force the water out through the opening in the bottom.

Work was begun by the North American Wrecking Company on September 7, 1906, and the vessel was floated on November 16, 1906. Everything in regard to the operations was calculated with mathematical accuracy. The calculations for the buoyancy required, and at the points chosen, were most fortunate.

It was necessary to timber solidly between decks above the several compartments that were to be used as caissons. The hatches were closed by plating. Air locks were placed on the compartments which were to be treated as caissons. Every opening in the deck, scuppers, etc., was closed.

When the air was applied the water rapidly receded and workmen were able to stop the rents in the bottom with temporary plating. In some of the holds even, the leaks were not closed, and the vessel was floated without a bottom. Pressure-men, that remarkable class of men who make it their business to work in compressed air, and who are commonly known as "sand hogs," were brought from the Quebec Bridge, the caisson work of which had shortly been completed, or from New York, the superintendent of the work having for many years been engaged in compressed-air work about New York.

A wooden tank of about 200 tons capacity was built directly between the engines, and the weight of the engines (180 tons) was carried by this tank. On the day of flotation about 25 tons of water were left in the tank. As the vessel rose and the engines settled to their old level, blocking was put between the tank and the deck over it, and this water pumped out, the surplus lift of the tank being transferred to the vessel. The heavy tides of the St. Lawrence, although the center of the vessel was flooded, lifted the end of the vessel, and the craft rose and fell with high tide, so that the engines rose and fell on some occasions 14 inches.

Air bags and tested barrels were used in the after bunkers. The boilers were blown out, and air was applied to the forward bunkers, they, too, being treated as caissons.

Several of the holds where the bottom was not so badly destroyed that it was necessary to treat them as caissons were pumped out, 8 and 10-inch centrifugal pumps being used for this purpose.

Owing to bad weather the tugs which had been lying alongside on November 16, the date set for flotation, had dropped down the river to a more sheltered position. As the tide rose the air compressors were set to work and the full power of the plant used in forcing air into the holds of the ships. Suddenly there was a movement in the great vessel as she lifted herself from the rock and a cheer went up from those on board. Five minutes later the "Bavarian" floated clear of Wye Rock in 60 feet of water, and was hauled to her anchors, which had been set off her port bow and quarter. After the first few minutes all apprehension that the vessel might turn turtle or that the air pressure would not hold the water back was dispelled. The "Bavarian" floated on an almost even keel and was shortly after towed by tugs to Quebec. The wrecking operations were under charge of William Wallace Wotherspoon, C.E., superintendent, who had entire charge of the wrecking operations inside the bulwarks of the vessel, and Mr. R. O. King, C.E., who was controlling engineer. Capt. W. Leslie, of Kingston, had charge of all nautical work.

CONTROLLING TORPEDOES BY WIRELESS TELEGRAPHY.

A torpedo-launching apparatus, which is operated by electric waves, has recently been tried in France, on the Mediterranean coast. It consists of two cylinders

Fig. 1.

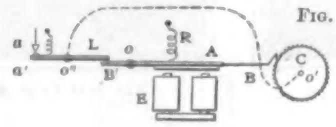


Fig. 3.

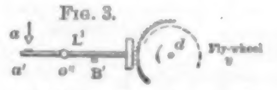
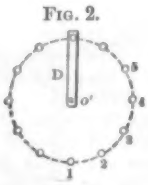


Fig. 2.



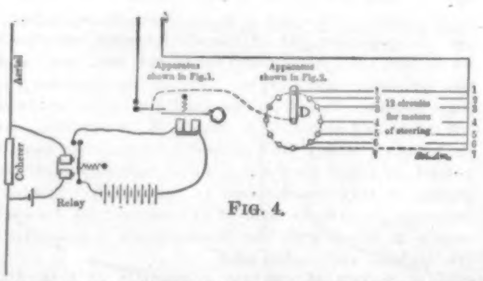


Fig. 4.

CONTROLLING TORPEDOES BY WIRELESS TELEGRAPHY.

placed one above the other, the upper one acting as a float which holds the mast wire, while the lower cylinder contains the torpedo and the launching device. The method of carrying out the maneuvers of the apparatus from a distance by the electric waves has been devised by M. Devaux, who gives the following account of the method. Up to the present the Hertz waves have been utilized generally for operating an electro-magnet, whose armature makes the well-known signals as in the Morse instrument, and this is the method used in wireless telegraphy. However, the movement of the armature can evidently be used to set free the force of another instrument, thus acting as a relay. Up to the present, the devices in use allowed of using one electro-magnet for operating two movements only, corresponding to the up or down position of the armature. To carry out a series of maneuvers which have no connection with each other, it is necessary to have as many electro-magnets as there are operations. This, though complicated, would be possible in the case of wire transmission, but it is not practicable for electric waves, seeing that as yet we are unable to separate the waves so as to have them act on different coherers located at the same point. We proposed the problem of setting in movement from a distance by electric waves, of a series of forces, acting in an order always variable and keeping independent of each other, and we devised a new method for the operating apparatus. This apparatus is used with each of the coherers, and can also be used with a wire-transmission system. In the latter case they need only one wire, using the earth as a return.

The present system consists, first, of a distributing device passing over all the contact points from which start the different operating circuits, and second, a commutating switch which sends the current at the right moment when the distributor has reached the proper circuit. To carry this out, an electro-magnet *E* (Fig. 1) can attract an armature, *A*, which is held back by the spring, *R*, and is pivoted at *O*. This armature is prolonged at each end by the arms, *B* and *B'*. The arm, *A*, provided with a pawl, works upon the ratchet wheel, *C*, which is mounted on the shaft, *O'*, of the distributor. The wheel thus advances one tooth at each attraction of the electro-magnet. At the other end, the arm *B'* strikes each time against the end of the lever, *L*, which is pivoted at *O''* and which works the contacts, *a a'*. Mounted on the shaft, *O'*, of the distributor is an arm, *D* (Fig. 2), whose end works upon a set of contacts 1, 2, 3, etc., and sends current from *O'* into twelve circuits. Each movement of the electro-magnet thus moves the arm around one contact. The electro-magnet is operated by aerial waves, using a coherer, or again by a line wire. In Fig. 3 is seen the second part of the device for shifting the circuits. The arm, *L'*, lies in another plane from the arm *B B'*, and on the forward end it carries a small rack and pinion device which is not seen in Fig. 1. The rack, sliding over the wheel, *d*, engages with it when the lever, *L*, is out of its normal position. In coming back, the rack draws the wheel with it, but as the latter carries a flywheel on the shaft, this gives it a certain inertia and retards the fall of the lever. During the series of attractions of the armature, the contact at *a a'* is thus kept open, and it is only when the armature is stopped and therefore when the distributor arm has come to the proper point, that the contact is closed. The apparatus works as follows: When at rest, the arm, *D*, remains upon contact No. 12, which is a dead point. The lever closes the circuit at *a a'*. We now wish to close circuit No. 7 without interfering with the others. It suffices to send 7 currents or 7 sets of waves with the rhythm $1 = t$. The electro-magnet will work 7 times at this frequency and will make the ratchet wheel, *C*, advance by 7 teeth, whereupon the arm, *D*, comes upon point No. 7. But now the contact at *a a'* has remained open on account of the inertia, as we have seen, of wheel *d*, and it is only closed when the arm, *D*, comes to rest. We thus close circuit No. 7 without operating the others. Again, we may wish to close several circuits at the same time. To do this, the distributor must be free to move without breaking the circuit which has been closed. It suffices that circuits 1, 2, 3...12 be closed by locked relays, and the latter serve to operate the work circuits. These relays are closed and remain so when the current passes, and their opening depends upon a device connected with one of the contact blocks.

In Fig. 4 is shown the apparatus for operation at a distance. It is connected in the place of the usual Morse receiver for aerial telegraphy. We have applied these apparatus to operating torpedoes at sea, and thus need the following maneuvers: 1. Forward run. 2. Back run. 3. Stop of propeller motor. 4. Rudder to right. 5. Rudder to left. 6. Stop of the steering motor. 7. Lighting of the signals at the front. 8. Lighting at rear. 9. Launching of the torpedo. The apparatus uses 12 points, thus having 3 points free. The speed allowed for making a complete round of the distributor is 2 seconds. The nine working circuits closed upon seven locked relays which worked the propeller and steering motors, signal lamps, and launching apparatus. Inside the torpedo is placed a set of Fulmen storage batteries which give a four hours' run. The torpedo is formed of two cylinders of sheet iron with conical ends, connected one above the other. It weighs 6.8 tons. The top cylinder, 30 feet long and 3 feet diameter, serves as a float, and it carries two small masts to which are fixed a receiving wire and a set of signal lamps. The lower cylinder, which is 35 feet long and 3 feet diameter, contains a torpedo launching tube and a Whitehead torpedo, besides the battery, motors, etc. The land post has a mast wire 50 feet long, in fine strands. A distance from 400 to 5,000 feet was covered in the trial. The latter took place in the port of Antibes on the Mediterranean. These tests have proved satisfactory as regards the different maneuvers of the torpedo-launching apparatus from the post on shore.

A Dry Shampoo.

People who are susceptible to colds, and who fear to wet their hair during the winter months, will find a dry shampoo with orris, in connection with brushing and massage, very effective.

Ten cents' worth of powdered orris is amply sufficient for two shampoos. When ready to retire, and after carefully brushing the hair, apply the orris, rubbing it in well with the finger tips, then put on a cap or tie the head up in a towel and allow it to remain over night. The orris will absorb the oil and dirt from the hair and scalp during the night, and can be brushed out in the morning.

Orris is not only an effective shampoo, but a very agreeable one; imparting a distinct yet dainty evanescent odor to the hair. By its use the head and hair can be kept in a perfectly cleanly condition. Frequent airing, brushings, and massagings will add to the beneficial results.

Correspondence.

The Transmission of Life from Star to Star.

To the Editor of the SCIENTIFIC AMERICAN:

Under the above title in the SCIENTIFIC AMERICAN of March 2 you gave a synopsis of Prof. Svante Arrhenius's theory that "the germs of life are conveyed through interstellar space from one heavenly body to another." His theory seems plausible and his arguments quite convincing, and his concluding thought, that "all organisms in the universe are related, and the process of evolution is everywhere the same," is splendid. But if his theory is true, it does not solve the problem of life—it simply pushes it farther from us into time and space.

If life came to our planet, to our solar system, from other worlds, that does not explain its origin. To me it seems beyond conception that life did not at some time and in some place have a beginning. When it began it must have been by spontaneous generation or by special creation. The professor shows quite conclusively by qûoting high authorities that all the theories for spontaneous generation have been discredited. So does this not leave the special creationist still "on top" in the controversy? C. W. BENNETT.

Coldwater, Mich., March 2, 1907.

The Korn Photographic Facsimile Telegraph.

To the Editor of the SCIENTIFIC AMERICAN:

The description of Korn's telephotographic apparatus in the SCIENTIFIC AMERICAN of February 16, 1907, mentions a truly marvelous property of selenium, which appears to indicate that this old favorite is determined not to be outdone by radium or any other upstart. The writer states that selenium "is not only sensitive to varying intensities of light in its electric conductivity, but is also affected thereby in its resistance." Hence the necessity of employing a second selenium cell with the same sensibility "in the opposite direction." In the new apparatus, furthermore, the needle galvanometer is replaced "by one of the chord type," but the function of the galvanometer is not given, nor does it appear in the diagram. Again, in the receiving apparatus the beam of a Nernst lamp is focused on a Geissler tube which is in the electric circuit, "and the variations of the current are thus retranslated into variations of light." *This* statement agrees with the diagram, which represents the Geissler tube as being energized directly by the feeble current from the distant sending station!

In the older form of receiver, as described in the SCIENTIFIC AMERICAN of November 25, 1905, p. 417, there were a Tesla inductor and tube, and the galvanometer, traversed by the varying line current, "according to its position switches more or less resistance into the Tesla circuit."

According to a description and diagram in La Science au XXme Siècle, January, 1907, the variation of resistance is effected by varying the length of two spark gaps, each of which extends from a fixed electrode to one end of a rod carried by the galvanometer needle. The current through the tube and spark gaps is furnished by a Tesla apparatus and no Nernst or other lamp sends its beams through the tube. The property of selenium which the second cell is designed to compensate is referred to as *inertia*, or retention of light—that is, slowness of recovery. The action of this second cell is not explained nor is it shown in the diagram, which is probably of the older apparatus, but reference is made to a paper read before the Académie des Sciences on December 3, 1906.

LAWRENCE B. FLETCHER.

Marlborough, N. Y., February 19, 1907.

The Two-Cycle Motor.

To the Editor of the SCIENTIFIC AMERICAN:

Referring to the article in the Motor Boat number of the SCIENTIFIC AMERICAN by Commodore Willets, I wish to state that it is not yet a settled fact that the four-cycle engine is the ideal for marine propulsion. This matter is far from being settled. It is the honest opinion of the writer (who has been connected with the development of marine engines for fifteen years) that the two-cycle type of internal combustion motor will in time enjoy the most general adoption for boat propulsion, because of the favorable features it presents for this purpose. The four-cycle engine has had the attention of engineers to a great extent, while the two-cycle has excited little interest; this is because of business reasons. A firm dislikes to bring out something new if it can copy or follow something that has been tried. However, the fact that something else has not had a fair trial is no evidence that it is of less value. There is a large number of reputable shops now giving their attention to the two-cycle, not only for heavy marine work, but also for stationary operation, such as electric drive, and these firms should receive some encouragement from government engineers, as well as from the public, when they can show results.

No engineer will doubt that the principle of a two-cycle engine is far superior to that of a four-cycle, because of its ability to operate at variable speeds and at very slow speeds. It also inherits the ability to reverse instantly without the addition of complex mechanism; the construction of a two-cycle engine is extremely simple as compared with that of the four-cycle, and best of all it has the great advantage of an impulse at every revolution per cylinder, which produces a more even torque and approaches the turbine principle in reducing vibration. The fact of the increased number of explosions per cylinder permits of a smaller cylinder and stroke per horse-power. One of the disadvantages of the four-cycle lies in the overheating of the exhaust valve, a fault which is entirely overcome in the two-cycle.

There is no question but that in time the two-cycle engine will become the standard motor for vessels; and with careful designing, together with improvements such as means for scavenging the cylinder with air at each stroke and using producer gas as fuel, it needs only the attention of the builders to bring it to the front. A READER.

Oshkosh, Wis., February 28, 1907.

The Bite of the Gila Monster.

To the Editor of the SCIENTIFIC AMERICAN:

Having read your article about Gila monsters in the SCIENTIFIC AMERICAN of January 26, I desire to state that I know one of the cases mentioned to be true. I have had some experience with Gila monsters, and can state that no matter what scientists may claim, the Gila monster is a good thing to shun. Indians and Mexicans have a horror of them, and fear them more than a rattlesnake. Old settlers here know of many cases of Gila monster poisoning, in which the effect was death. I believe that the bite of the Gila monster is dangerous because of the creature's habit of eating lizards, bugs, and rodents, and then lying on sand so hot that it blisters the hands and feet. The heat causes the food to putrefy in the stomach, evidenced by the fact that the teeth are often covered with a fermented, putrefied froth from the food. A bite has the same effect as the cut of a dissecting knife used on a cadaver; in other words, the inoculation of a deadly poison.

I spoke of the sluggishness of the Gila monster to all appearances as it lies in the sand after a feast. This is true within certain limitations. Most people do not know the Gila monster, and have never seen him in action. When frightened or angry, he can move quite rapidly, and he develops some traits not generally known. That short, thick, stubby tail of his is apparently merely a heavy tail to drag around to make him more sluggish. The thick tail is used in jumping, just as a kangaroo uses his tail for the same purpose. The Gila monster bites like a bulldog, and has the tenacity of a snapping turtle. Small wonder then that his bite is so dangerous. To cite an instance of his jumping powers, I may mention that I once saw some men teasing a Gila monster brought to Tucson. A string was tied around his neck, and a crowd naturally gathered out of curiosity. The Gila monster was crawling around on the ground, trying to get away, but was pulled back by the string. This was carried on till the creature became furious. The crowd around the Gila monster knew nothing of his power to spring. Suddenly he sprang up and bit a man among the crowd on the hand, leaping fully two feet from the ground. The monster was crawling at the time, and the string was slack so that it was not jerked up in the air. I may here record still another instance. This of a man whose chief object seems to have been a bravado display of fearlessness. He was holding one of the monsters in his hand by the back of its neck, so it could not bite him. He dropped his hand to the side of his leg. The Gila monster shut his teeth down on his heavy duck overalls, taking a double piece out where the cloth folded, as quick as a pair of scissors could have cut the fabric, and as cleanly.

The Mexicans and Indians after killing a Gila monster always hang it up by the neck on a bush so that it cannot possibly touch its feet, and leave it till it is flyblown or smells before they will trust to its being dead. The creatures apparently are hard to kill or else feign death. HENRY M.

Tucson, Ariz.

A Quick Method of Repairing a Broken Shaft.

To the Editor of the SCIENTIFIC AMERICAN:

The writer recently, almost by accident, hit on a method of repairing a broken shaft, so cheap, so quick, and so surprisingly strong, that he thinks it may be of service to your readers. The use of the method would often obviate a long and expensive delay and loss of work, for the shaft gives nearly as good service as before it was broken. The SCIENTIFIC AMERICAN is so universally read, that no better medium to put it before the mechanical public could be found, and hence it is offered to you in the hope you may find it of sufficient interest to print.

To be brief, the writer has under his charge a hydraulic dredge, used on the Mississippi River improvements in the vicinity of Keokuk, Iowa. This dredge is driven by a compound high-pressure engine, 14 and 24 by 15-inch stroke, running 220 revolutions per minute and developing about 250 horse-power. The steel shaft of this engine, 6 inches in diameter, broke about 10 inches from one of the cranks. The cranks are quartering, and the shaft is a highly finished one that takes a long time to build even under the best of circumstances. It was, as you can see, a difficult task to weld this shaft so as to repair it, as the stub-end was so close to the crank that to heat it sufficiently was likely to warp the latter out of shape and spoil the whole shaft. The attempt was made, however, and the shaft promptly broke again at the same place, although a whole week and a large expense had attended the effort to put the shaft in working condition. It looked as if the crew of sixteen men would have to be given indefinite furloughs, and the dredge laid up for at least six weeks while a new shaft was being built. The broken shaft was taken out, and was lying on the shop floor for measurement for the purpose of ordering a new one, when a casual traveling man happened to come along with some sort of engineering merchandise to sell, and heard the history of the shaft. He remarked that he had once mended a similar break in a cold-storage engine shaft, where it was of the utmost importance to keep the machinery at work. This shaft was, like ours, broken too close to the crank to permit of welding, owing to the springing out of shape that would take place if heated. He said that, more in the hope of doing some good than with any expectation that it would last, he simply squared the two broken ends and screwed them together with a stud that went half into each piece of shaft. He said that they started the engine, and, to the surprise of every one, the shaft seemed as good as before breaking. They got a new shaft, but they did not take time to put it in, waiting to see the mended shaft give some sign of breaking. It ran the season out, and was still apparently fully up to its work, when they finally put in the new shaft; not because the old one showed any weakness, but "just to avoid trouble."

This tale was no sooner concluded, than my broken shaft was put into the lathe, and work begun on it to make a similar repair. Squaring the ends shortened the shaft some six inches, but this could be remedied by moving in the outboard pillow block. A chunk of soft and tough steel, that had once done duty as a wristpin for a large engine, was selected from the scrap pile. This was cut off 10 inches long and turned to 4 inches in diameter; it was then threaded the whole length with a screw of four threads to the inch; each piece of shaft was then bored and threaded to fit this screw, and then finished the stud was screwed into one piece of shaft, and the other piece screwed home. To make the job a little more solid, the stud was dipped into salt and water to make a rust joint of it, and keep it from coming unscrewed by any chance.

It took an afternoon and part of the night to complete this job, and the next morning the shaft was replaced in the engine and put to work. It has never shown the least indication of weakness so far, and is still, after eighteen months, apparently as good as ever. The new shaft, ordered as a hurry job, was received in two months, but is still kept in reserve. The joint between the two pieces of shaft was fortunately an inch or so inside of the pillow block, and is now undistinguishable from the rest of the shaft. The work of the engine, of course, always tends to screw the pieces tighter together; but it seems a little surprising that the threads do not strip off and let the two pieces separate. Probably the friction between the outer parts of the shaft takes up most of the torsional strain. The 4-inch stub would not last a minute by itself.

It suggests the idea that a shaft may be lengthened almost indefinitely, and do good service without any couplings, by simply screwing the ends together. This would in many cases be a great convenience. The experience on this engine at least goes to show that it is a method of uniting pieces of shafting far stronger than is generally supposed. It would be of interest to have tests made with pieces of shafting made for the purpose, to see what proportion of the original strength of a shaft this method of uniting them gives.

I would give the name of the ingenious man who suggested this repair, if unfortunately he had not gone the way of other drummers and been forgotten. I send with this a scale drawing to show plainly just what the joint looks like, together with the break in the shaft, and hope that some one may find the idea as valuable as it was to the writer. There is no reason why the shaft need to have been shortened, as a short piece of shafting with a stud on each end might just as well have been used, and would probably have been just as strong. MEIGS, U. S. C. E.

Keokuk, Iowa, December 17, 1906.

The French Minister of War has ordered a census to be taken of industrial vehicles capable of being mobilized for military transport. The wagons will be divided into three categories, according to the load carried. Public service vehicles will also be included.

AN INTERESTING GERMAN FLYING MACHINE.

BY DR. ALFRED GRADENWITZ.

The flying machine illustrated herewith is arousing much interest at the present moment in German engineering circles; it has been developed by Privy Councilor J. Hofmann, of Berlin, during more than twelve years' strenuous work, in spite of early lack of success and encouragement.

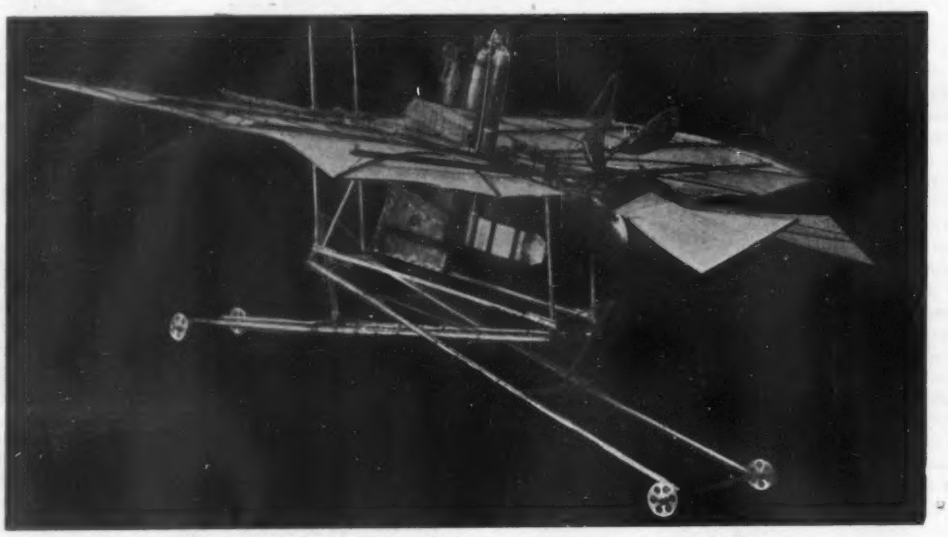


Fig. 1.—The Flying Machine as It Would Appear in Full Flight.

Hofmann began his experiments as early as 1895 with a trial similar to Lilienthal's fatal flying experiment, gliding with an aeroplane from the roof of a small factory building. In connection with a more extensive experiment, the flying machine was placed on a cart pushed by workmen, while two men on the cart held the device in position. As, however, one of these men, contrary to instructions, left the cart, the machine was caught up and broken by a sudden gale of wind. In consequence of this failure Hofmann lost the support which he needed for the work, and was himself obliged to install a small workshop in a dwelling room in which several flying machine models, on a scale of about 1 to 10, were constructed. All these had identical steam boilers and engines, but different propellers, wings, and legs. In spite of the successful flying experiments carried out with these miniature airships, the public remained skeptical in regard to Hofmann's work, it being thought unlikely that similar success would attend experiments on a large scale. Santos Dumont it was who proved that the success of flying tests is independent of the size of the airship.

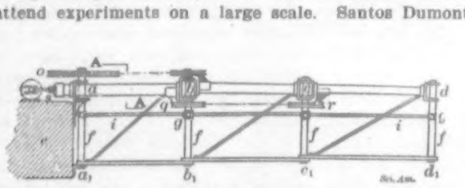


Fig. 3.—Side Elevation of the Extended Left Wing of the Machine.

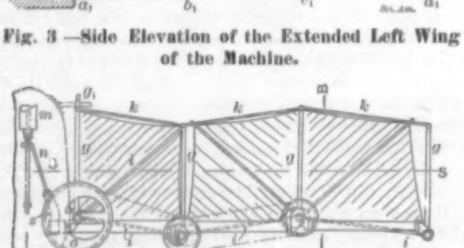


Fig. 4.—Plan View of the Left Wing.

A committee of supporters having finally been formed, the inventor commenced the construction of a large-sized machine. In place of wings rigidly fixed to the body, Hofmann uses movable wings, which, like those of insects, are folded up against the body when the latter is at rest, and are stretched out to the right and left during the flight. In the case of a large-sized machine, however, it becomes necessary to subdivide the wings like those of birds and bats, as represented in Figs. 3, 4, and 5 of the illustrations herewith. Fig. 3 is an elevation of the left-hand wing extended, and Figs. 5 and 6 are plan views; *e* is the body of the machine flying in the direction of the arrow; to both sides of this framework the girders of the wings are applied. The vertical rods *f* carry at the rear the outriggers *g*, which in turn are connected together at the back. To the upper ribs *a*, *b*, *c*, *d*, or to the lower ribs a_1, b_1, c_1, d_1, or to both of them, or finally to special rods *i*, there may be fitted horizontal sails secured to the rods *g*, both at the front edge *i* and at the lateral edge, while the back edge and other lateral edge are usually left unattached. During the flight of the machine the air will throw the sails from underneath against the framework members *k* and *g*, while after the landing the framework girders are folded immediately by a single motion of the piston *m*.

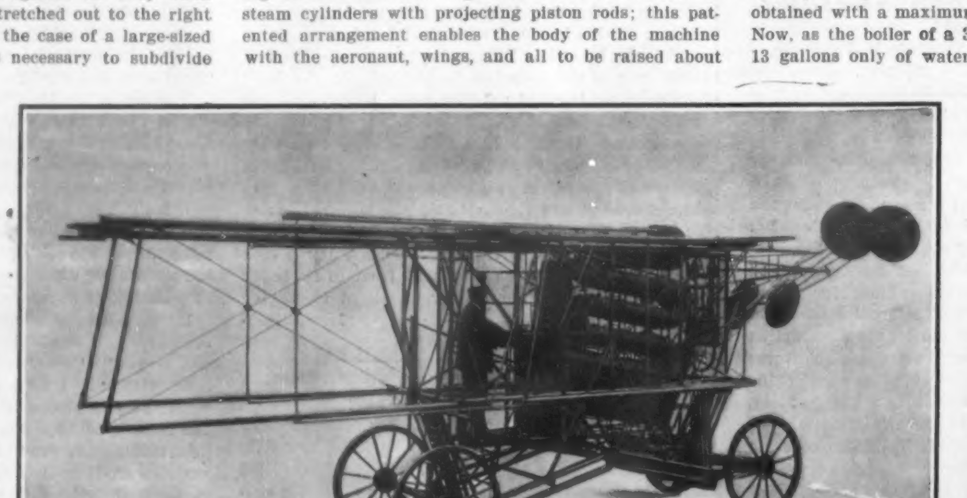


Fig. 2.—The Incomplete Hofmann Flying Machine During Construction.

AN INTERESTING GERMAN FLYING MACHINE.

In the machine constructed by Hofmann the part *a b*, corresponding to an upper arm, is 10.9 feet, the lower arm *b c*, 11.9 feet, and the hand *c d*, 12.9 feet in length. As the body itself is 5 feet in breadth, the total width of the flying machine is 76.5 feet, while the length in the direction of flying from the front edge of the propeller to the rear edge of the rudder is 26.5 feet. The machine, when traveling on land with folded wings, is 33 feet in length and over 13 feet in breadth. Another feature of the machine is the fact that the wings, when stretched out, can be moved both in a forward and a backward direction, thus replacing the rudder or correcting any mistake in the adjustment of the center of gravity.

Much time and money were expended on trials intended to ascertain the most convenient shape of propeller screws. The design of the propeller at present adopted will be seen from Figs. 1 and 2, which were made from photographs of Hofmann's full-sized machine. It is, however, intended to reconstruct this machine, adapting it to combustion motors, and then a patented type of propeller will be made use of. These improved propeller screws are, like the above, mounted on arms connected with the shaft, while free to rotate in bearings in which they are turned around during operation by means of a handle. The forward and backward motion of the machine is thus controlled by this handle, dispensing with the use of any change gearing, as in the case of ship screws with adjustable blades.

The flying machine at present constructed, as seen from Figs. 1 and 2, comprises a quadruple screw propeller arranged in front with its shaft, behind which the steam engine is located. The axles of the four wheels are fitted to the ends of lengthy springs placed in guiding tubes, which are free to rotate around the center of the machine. Between the upper frame of the machine and the front and rear bogies corresponding to fore and rear legs there are two reinforced steam cylinders with projecting piston rods; this patented arrangement enables the body of the machine with the aeronaut, wings, and all to be raised about four and a half feet. While the body of an animal is provided with a backbone, breastbone, and ribs, inside of which the more sensitive organs are hidden, this winged flyer has a protective framework of steel tubes and rods inside of which the motive parts are arranged. The steam boiler and superheater are of zigzag form; the steam raised in the lower part of the water-tube boiler rises into the steam chamber, placed immediately in front of the aeronaut, where the water is separated out and returns to the boiler, through return pipes; the moist steam is conveyed to the superheater located on the top, running toward the fire as far as the lower boiler, and finally through the fireplace to the throttle valve near the driver's position and thence to the propelling mechanism. The driver's position, in addition to the devices usual in connection with locomotives, contains all apparatus for controlling the auxiliary machinery, thus allowing the flying machine to be lifted or lowered and the wings to be extended or folded up by means of a single manipulation in each case. It further contains the handwheel for steering the front wheels, the machine being used on land as an automobile, and two levers for the two horizontal flight rudders arranged behind the engine on either side of a stationary vertical keel. The flight rudders as well as the sails of the wings have not yet been placed in position.

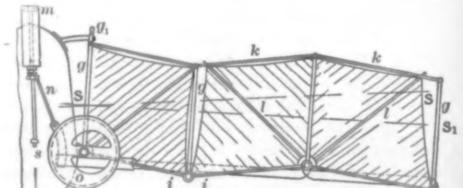


Fig. 5.—Plan View of the Extended Wing.

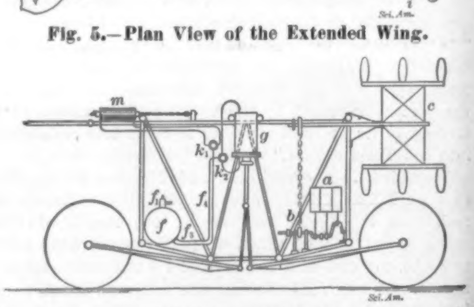


Fig. 6.—Auxiliary Motor for Actuating the Wings and Legs.

If the boiler be heated with charcoal, a superheat corresponding to the temperature of melting lead is obtained with a maximum pressure of 15 atmospheres. Now, as the boiler of a 30-horse-power engine contains 13 gallons only of water, while the copper tubes (0.2 inch in outside diameter and 0.17 inch in inside diameter) represent an aggregate length of 7,260 feet, it will be readily understood that the control of the fire is not an easy matter. The fluctuations in the consumption of steam, depending on the working of the auxiliary machinery, and the operation of the copper tube superheater, exclude any possibility of a single operator tending the boiler and engine, and steering the machine through the air. Now, as internal-combustion motors are at present constructed so light in weight, Mr. Hofmann, as above mentioned, intends substituting such a motor for his present engine.

After making this substitution, the construction will be as shown in Fig. 6. The motor *a*, while the propeller *c* is running at no load, fills

the reservoir, f, with compressed air until the latter is continually discharged through the safety valve f_1. The flying machine, whose supporting surfaces and rudder are arranged in the direction of the propeller axis, is then slowly lifted through 4½ feet by allowing air to enter through k_3 into the cylinder or cylinders g. The propeller is next adjusted for forward running, while compressed air is introduced through k_1 into the cylinders m, thus unfolding the wings suddenly. As the whole wing surface remains parallel to the ground, the flyer is drawn by the propeller at a speed of 10 to 12 yards a second. At this very moment the direction of the air in the lifting cylinder g is reversed by turning the cock k_2, thus causing the legs of the airship to be pulled upward, and allowing the machine to fall freely 4½ feet. It actually falls some distance while being launched forward, and even if this distance be only half a yard, an increase in speed of about 3 yards will be derived therefrom, thus giving an initial flight speed of 13 to 15 yards per second. If the center of gravity of the whole machine be so placed in regard to the wings that the former, while transmitting its load to the wings, is rotated, e. g., to a certain extent lifted in front and lowered backward, the flight is bound to continue, the rudder being actuated in the case of a permanent operation.

In landing, the speed of the propeller is reduced while adjusting the wings to a steeper inclination by lifting the two back rudders; then the whole airship slowly drops upon its rear legs, and in a half-flying and half-rolling motion falls on its fore legs. By reversing k_1, the compressed air in the cylinder m is immediately controlled in such a way as to draw the wings abruptly to the body, thus ending the flight.

As regards the performance of this kite flyer in bad weather and winds, a special point has been made of imitating the behavior of birds. It should be remembered that all birds in their tails possess approximately horizontal surfaces, by means of which all horizontal and vertical motions as required in flying can be obtained.

If now the bird unexpectedly is taken sideways by a sudden gale, it is struck behind its center of gravity by a far greater number of air particles than in front of the center of gravity. It thus quite automatically turns toward the wind, thereby eliminating any danger. For this reason the inventor has provided his machine with rear rudders and an intermediary stationary vertical keel, in the place of the front rudder used by Santos Dumont, which on the above theory would be rather dangerous.

Covering Hat Bodies with Silk Plush.

Cutting Out Plush Hat Covers.

THE STORY OF A SILK HAT.

BY JACQUES BOYER.

In the making of the silk hat, that indispensable accessory of fashionable masculine attire, comparatively little use is made of the marvels of modern machinery that play so important a part in most of the arts and manufactures. The construction of a silk hat includes five stages: making the foundation or body (called in French *galette*, that is, "pie crust"), covering, shaping, sewing the silk plush cover, and, finally, lining and trimming. The body is composed of several thicknesses of very fine muslin which are wrapped around wooden forms (blocks) representing the styles of the season. The muslin, before it is put on the blocks is stretched on frames brushed with a solution of shellac in alcohol containing a little ammonia, and dried in the open air or in well-ventilated rooms, according to the season and the weather. The foundation, or body, thus constructed is varnished. It is as hard as wood, very light and absolutely water-tight. If it is thrown on the floor it will rebound without becoming deformed. In order to make the foundation exactly fit the wooden block, which is smaller in the middle than at the ends, the first strip of muslin is cut bias. The innermost layer of the top of the hat consists of satin or watered silk. To this the prepared muslin is applied in one or more layers. The foundation of the brim is made of two or three layers of stouter muslin coated with shellac, which are pressed together and smoothed by a machine which consists essentially of

Shaping and Curling the Brim.

Coating Muslin with Shellac for Foundation.

Making Brims.

Shaping Hats After Covering.

THE STORY OF A SILK HAT.

two cast-iron rollers mounted on a heavy iron frame and heated by gas. This machine is rolled several times over the still flat brim foundation to which it gives the required stiffness. The brim is then clamped between a wooden plank and a zinc plate, in each of which is a hole slightly larger than the inside of the finished hat, and the inner edge of the brim which projects beyond the plank and zinc plate is bent at right angles by the application of a hot iron of peculiar shape and trimmed with knives to remove the irregularities produced by this operation. The short tube thus formed inside of the brim foundation is fitted to the foundation of the crown and the two are fastened together by the application of a hot iron, the hatmaker's most important tool. Then the entire body receives another coat of varnish and, after drying, it is ready to be covered with silk plush.

The covering is in two pieces, a circle and a rhomboid. The illustration shows a girl tracing the outlines with chalk on the back of the plush and another girl cutting out the pieces. A skillful needlewoman then sews the pieces together. This is a very delicate operation, for the seams must not show in the finished hat. The plush is stretched tightly and the nap is brushed over the seams.

In the operation of covering the hat, cashmere is glued on the lower side of the brim and silk plush on the upper side. Then the wooden block already used, which is composed of five sections, is wrapped with cotton wadding and forced into the hat body in order to stretch it as much as possible. The plush cover is next forced over the body and smoothed and made to adhere by the application of a wire brush, a damp sponge, and a hot iron. Then comes the most difficult and delicate task of all, the joining of the side to the brim by an invisible seam. The entire surface is again dampened and ironed and the hat is placed on a lathe and polished with a strip of velvet, which cleans the plush perfectly and gives it a brilliant gloss.

The inequalities in the crown caused by the five-parted form on which it was forced are removed by placing it and turning it on a gallows-shaped heated iron tool, an operation which requires great strength as well as skill and taste. The crown is now covered with paper to protect the surface and the flat brim is molded to the desired form and slightly curled. The edge of the brim is then sharpened with knife and plane, covered with silk braid and finally shaped to suit the particular style desired or the taste of the wearer, if it has been made to order. The final operation, performed by girls, is the insertion of the leather sweat band and the silk lining.

The silk hat of the twentieth century can defy the elements. It is less ornate than its ancient prototype of soft felt garnished with plumes, but it is far lighter and more durable.

The Finishing Touches.

Final Shaping of the Brim.

THE STORY OF A SILK HAT.

The man who buys a 1907 model will get something bigger and better in the shape of a car than he ever dreamed of a few years back, but the item of depreciation appears to remain stationary despite the vast improvement that has been brought about. And in this connection depreciation must be considered in two senses—actual and financial. The former is the reduction in value that the car has actually suffered through wear and tear on its mechanism, accidental injuries, and the like, and the latter is the slump in its market value that has come about merely through the fact that it has been used and regardless of how little it may really have lost. That it has been run an entire season or only a month appears to make little difference. The blight of being second-hand is upon it. And even though it may actually fulfill every representation of the owner anxious to part with it regarding the short distance it has been run and its perfect condition, it is extremely difficult to realize more than 60 per cent of its original selling price. This does not represent an extreme in either direction. In occasional instances more may be realized, but in the majority it is less and the item of depreciation is correspondingly heavier. The car that sold for $2,000 when new will seldom bring much more than half that price when a year old, and at the end of its second year this will practically be halved again, despite the fact that as a well-built piece of machinery it may have several years of efficient life before it.—Motor World.

A New Use for Concrete.

Repairing breaks in the hull of a sunken steamer with concrete is a new departure, but one likely to prove frequently useful. The scheme was successfully tried upon the steamer "George W. Elder," which was sunk in the Columbia River over two years ago, and remained under water many months. The boat struck on a jagged rock, which stove several holes in her iron hull; the principal one, about 80 feet from the bow, measured about 35 feet in each direction. Through this enormous gap the rock projected into the hold for nearly 11 feet. A bulkhead was built by divers forward of the break, and another aft, and two more aft of the engine room. Heavy canvas was then placed over the rock which projected up into the ship, and concrete was placed over the canvas until a heavy covering had been obtained. This was supported against the outside water pressure by a concrete beam athwart the hold, measuring 18 x 48 inches and 38 feet long. The concrete was mixed and placed under water by divers, the cement being sent down a chute in sacks and the stone in a box.

Other smaller breaks having been similarly treated, the water was pumped out of the hold, and the vessel floated and towed forty miles to a drydock. One of the problems connected with concluding the operations involved the relation between the capacity of the pumps, which were discharging the water from the hold, and the flow through leaks developing around the huge cement cone, and at other points in the hull which had been severely strained by the action of the current during the sixteen months of submersion. By the terms of the contract under which the salvage operations were undertaken the successful wreckers received $30,000, as against nothing in case of failure. The original owners had sold the wreck for $10,400, and, as the cost of repairs was about $20,000, the outlay of the buyer amounted to about $60,000. After the ship was ready again for service an offer of $160,000 was made for her.—Iron Age.

An Interesting Use of the Telephone.

Two novel uses of the telephone are given in the American Telephone Journal. During the past summer public entertainments have been given in Riverview Park, Chicago, which is one of the largest of its kind in the United States. One of the novel features of these entertainments was the placing of telephone receivers attached to horns in several of the trees in different parts of the park. During the entertainment, music produced on a piano, a cornet, or songs was reproduced by these telephones, much to the mystification of the audience. This effect was made possible by means of the powerful transmitter devised by the International Telephone Manufacturing Company, of Chicago, known as the "Transmitophone." The soloist who gave the selection was located out of sight and was able to keep in time with the accompaniment of the orchestra by means of a special receiving circuit.

The other interesting use of the telephone was in reporting the Michigan-Ohio State football game. Two bare wires were stretched across the field, and a small trolley arranged to run on them. To this trolley was attached a portable telephone set, which was used by the reporter, who followed the progress of the ball along the field. This circuit was connected with the Ann Arbor (Mich.) exchange, and through it to the University of Michigan. In this way the progress of the game was followed at Ann Arbor almost as closely as it was on the field where it was played.

Preparation of Pure Helium.

A new method for the preparation of helium in a pure state is the subject of a paper presented to the Académie des Sciences by Messrs. Jacquerod and Perrot. In a preceding note, the authors called attention to the great facility with which helium is diffused through a quartz bulb which is brought to a high temperature. Their researches upon the expansion of gases showed on the other hand that silica is quite impermeable to other gases, with the exception of hydrogen, and perhaps carbon monoxide, up to the temperature of 1,952 deg. F. These observations led them to a method of purifying helium which may present a certain interest, owing to the difficulty found in the chemical or other processes used up to the present time.

A quartz bulb, which ends in a capillary tube of the same substance, is placed inside a cylindrical platinum tube of somewhat larger diameter, stopped by a metal plate which allows the capillary tube to pass. Sealing wax is used to make a tight joint. Side tubes allow of making a vacuum in the annular space between the platinum and the quartz, as well as inside the quartz bulb, and gas can be also introduced. The apparatus is heated to about 2,010 deg. F. in an electric furnace having platinum resistance coils, with the exception of the sealing wax joint, which is cooled by a jacket having a cold water circulation. The quartz bulb can be put also in connection with a mercury gas tank by means of a stop cock. A vacuum is first made in an almost complete manner in the two envelopes by using the mercury pump, then ordinary unrefined helium coming from the calcination of cleveite is introduced into the platinum tube at somewhat higher than atmospheric pressure, so as to hasten the diffusion. By adding to this impure helium from five to ten per cent of oxygen we can fix under the form of water vapor or carbonic acid, the hydrogen or carbon monoxide which may be present there. After a few minutes the pressure gage connected to the quartz bulb shows that the gas is commencing to diffuse. The pressure rises in a very regular way and after two or three hours a portion of pure helium can be introduced into the gas-holder. In these conditions the output of gas, with the quartz bulb containing 42 cubic centimeters is somewhat slow. It corresponds with about 1 cubic centimeter of pure helium per hour. On the contrary, the method, when once the apparatus is mounted, is easy to operate and the purification seems to be perfect. In fact, spectroscopic examination of the gas shows none but the characteristic rays of helium, which are very brilliant, and the nitrogen bands, although easy to see, are quite absent. Only the red ray (H) of hydrogen can be perceived, but it is very faint. It comes very likely from traces of hydrogen retained by the electrodes of aluminium of the Plücker tube, and it is known in fact how difficult it is to have the spectrum of this gas completely absent in a spectroscopic vacuum tube. Thus it is seen that the diffusion of helium through quartz at a high heat gives a good method of obtaining the gas in a pure state.

The Assay of Silver Bullion.

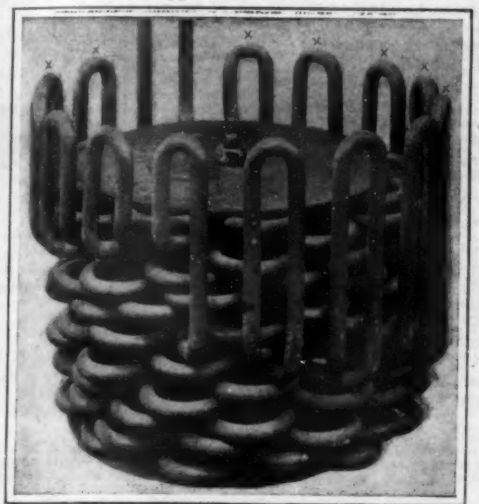
At the Institution of Mining and Metallurgy a paper was read recently by Mr. E. A. Smith on "The Assay of Silver Bullion by Volhard's Ammonium Thiocyanate Method." It has recently been the practice to modify slightly the method of finishing the assay by adding sufficient ammonium thiocyanate to the check assay to intensify the red color of the ferric thiocyanate, and to use this color as a standard of comparison. Experiments described by the author proved that, by finishing the assay in this way, a limit of accuracy of less than 0.1 per 1,000 of silver can be obtained by Volhard's method. Working in the ordinary way the limit of accuracy is 0.2 to 0.3 per 1,000.

The consumption of pig iron in Germany during 1906 amounted to 12,396,088 tons, against 10,739,871, an increase of 1,656,217 tons, or 15½ per cent. This makes a consumption per head of the population of 444.4 pounds, against 391.6 pounds in 1905 and 356.4 pounds in 1900—the previous boom year.

AUTOGENOUS WELDING WITH THE OXY-ACETYLENE HIGH-PRESSURE BLOWPIPE.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

Some interesting experiments have recently been carried out at Birmingham to demonstrate the possibilities and efficiency of welding by means of the oxy-acetylene blowpipe. With this system a temperature of over 7,000 deg. F. was obtained, which is a heat far



A Typical Example of Welding by the Oxy-Acetylene Blowpipe. The Tubes Were Welded at the Points Marked by Crosses.

exceeding that procurable with the oxy-hydrogen flame, with which a maximum temperature ranging from 3,600 to 4,500 deg. F. only is possible. Furthermore, whereas a cubic foot of hydrogen will only develop about 12,000 British thermal units, a similar quantity of acetylene will develop nearly five times as much—57,000 British thermal units.

For certain classes of welding, where especially intense heat is requisite, the oxy-acetylene blowpipe is eminently suitable, and during the past two or three years this system has come very extensively into vogue. At first considerable difficulty was experienced in the devising of a blowpipe for utilizing this gaseous mixture, together with the problem of storing the acetylene with complete immunity from premature explosion. These two obstacles, however, have now been successfully surmounted. The perfection of the process for storing the acetylene in a dissolved state has removed any liability of danger, provided ordinary care is displayed, while a highly efficient burner has been devised. At first it was considered that the acetylene could be employed with burners similar to those utilized for oxygen and hydrogen, but it was found that owing to the premature dissociation of the acetylene, whereby carbon was freely liberated in the form of graphite, the burners rapidly became choked, and then the hydrogen only in conjunction with the oxygen assisted the burning, the result being that the same effect was produced as if only pure oxygen and hydrogen were used, with the additional disadvantage of the burners becoming clogged.

A new process whereby these drawbacks are entirely and successfully eliminated has been perfected by the Acetylene Illuminating Company, of Lambeth, London, the notable feature of which is that the burner is so designed that the acetylene only dissociates in the actual burning. With this burner both the oxygen and the acetylene gases are utilized under pressure, instead of only the former being supplied to the burner under pressure. Demonstration has proved that by supplying both the gases under pressure a much higher factor of efficiency is obtained, while at the same time this arrangement enables the design of the burner to be considerably simplified. Furthermore, equal gas pressure dispenses with continual adjustments of the burner, as is the case where two varying pressures are being supplied to one flame, so that disarrangement of the burner is not a constant liability.

The High-Pressure Oxy-Acetylene Flame in Operation, Showing the Two Cylinders Containing the Respective Gases.

It is also much easier to maintain the adjustment of the flame with both gases supplied at an equal pressure, and once the regulation has been obtained at the correct point, it can be left. With a high-pressure oxy-acetylene blowpipe also, it is possible to obtain a more complete combination of the two gases, which is impossible in an appliance where the supply is maintained under varying pressures, and this attainment conduces to the higher efficiency. This feature too is of great importance, since there is a decreased consumption of acetylene to accomplish a fixed amount of work, rendering this system more economical in operation, and this economy more than compensates for the difference in cost between the dissolved and the crude acetylene supplied direct from the generator.

In order to insure the complete combustion of acetylene, a theoretical proportion of 2.5 parts of oxygen to 1 part of acetylene is required, but practical experience has shown that the requisite quantity of oxygen is much less, varying from 1.6 to 1.8. This factor, however, is completely influenced by the standard of purity in relation to the oxygen. This divergence between theoretical and practical requirements is attributable to the fact that by the high-pressure system the extra oxygen necessary to complete combustion is drawn from the surrounding air.

The high temperature of the flame from the oxy-acetylene blowpipe as compared with that of the oxy-hydrogen flame is due to the fact, that whereas in the latter the temperature is limited to the dissociation temperature of steam, in the former the temperature is limited only by the dissociation temperature of carbon monoxide, which is considerably higher than that of steam. Acetylene is an endothermic gas consisting of carbon and hydrogen, and with a high-pressure blowpipe it is split up into its two component parts at the base of the flame. The carbon only participates in the burning, since it will combine with the oxygen at a higher temperature than the hydrogen, so that the latter is left free, and constitutes a protective zone to the small cone at the nozzle of the blowpipe, where the carbon is burning, and which is the point of maximum temperature—approximately 6,300 deg. F.

The perfection of a system of dissolved acetylene has contributed in no small degree to the utility and safety of the oxy-acetylene blowpipe. The cylinder is filled with some porous substance, such as asbestos or charcoal cement of a fixed porosity, and is then thoroughly saturated with a fixed quantity of acetone. The latter is a liquid hydrocarbon, and has the peculiar property of absorbing twenty-five times its own volume of acetylene at atmospheric pressure and 59 deg. F., and will continue doing so for every atmosphere of pressure that is applied to the gas. The general arrangement in regard to the cylinders is to so regulate them that they contain ten times their own volume of acetylene for every atmosphere of pressure, so that at that pressure they contain one hundred times their own volume of acetylene. Any possibility of the gas exploding within the cylinder is completely removed.

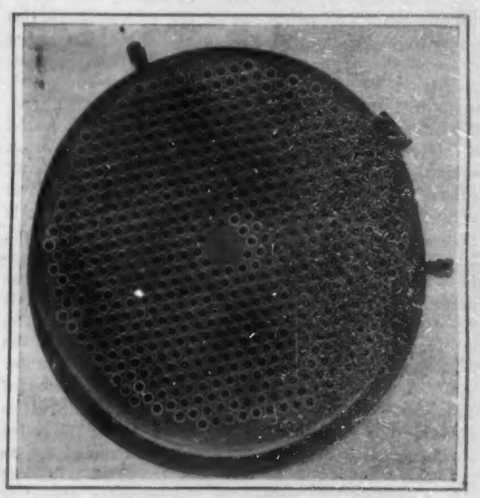
This process is particularly adapted for welding split tubing, flaws in tanks or boiler plates, boiler tubes, bicycle frames, and similar work. The accompanying illustrations show two typical welding operations that were carried out by this process. With the high-pressure system the operation is considerably simplified, since the operator, once he has obtained the desired regulation of the flame, can concentrate his sole attention to the work in hand, and does not continually have to adjust the supply, as is the case with varying pressures. As regards the time occupied in welding various thicknesses of plates, and the consumption of gas for the purpose, the following information is supplied by the French Bureau Veritas:

Thickness of Plates.	Approximate Quantity of Acetylene Consumed per Hour.	Approximate Time per Running Foot.	
Millimeters.	Cubic Feet.	Minutes.	Seconds.
1	0.3	2	..
2	0.7	2	45
3	1.2	3	..
4	2.3	6	45
5	3.6	8	30
6	5.3	10	..
9	13.0	15	..
10	16.1	16	45
12	26.2	20	..
15	43.8	26	45
20	84.0	34	30
30	253.0	60	..

It is essential, however, that the acetylene should be quite pure, as certain impurities incidental to acetylene, unless removed, are detrimental to the weld, and tend to render the joints either imperfect or brittle. Owing to its general superiority to the ordinary oxy-hydrogen blowpipe flame, it is extensively supplanting the latter process, while at the same time it possesses certain advantages over electric welding, inasmuch as no elaborate preparations or heavy initial expenditure in regard to plant are entailed.

The Age of Animals.

Some of the compound earth worms that have been produced at the Marburg Zoological Institute by grafting together parts of different worms have lived from 8 to 10 years after the operation. It is fair to infer that uncombined earth worms may reach the same age, a fact that was unsuspected and would have been deemed improbable. This discovery suggests a comparison with the ages of other invertebrates for which, however, few reliable data are available. Among the generally short-lived articulate animals lobsters and fresh-water crabs are said to live 20 years, queen bees 5 years, and queen ants from 10 to 15 years. Most mollusks, too, appear to be short-lived, but the fresh-water mussel is said to live 12 or 14 years (the pearl-bearing species more than 50 years, according to some writers), the sea snail, *Natica*, 30 years, and the *Tridacna*, or "yellow clam," 100 years. But the life of most invertebrates of all classes appears to be limited to one or a very few years. Hence it is the more surprising to find several well-authenticated examples of longevity among the lowly, plant-like sea anemones, of which one species has been known to live in aquariums 67 years and others from 10 to 50 years. It is impossible, in the present state of science, to explain



These Tubes Were Welded in Place by Means of the Oxy-Acetylene Blowpipe, With Which a Flame Having a Temperature of 7,000 Deg. F. Was Obtained.

these remarkable exceptions to the law which governs nearly-related animals living under similar conditions.

The same difficulty confronts us in the vertebrates. The great age of elephants (150 to 200 years) finds a plausible explanation in their great size and the unfavorable conditions for procreation, but there is no known explanation for the ages attained by some birds (the raven 100, the eagle 104, the vulture 118, the falcon 164, and the parrot a far greater number of years). The longevity of the giant tortoises, which are said to live 300 years, may also be explained by their bulk and their small expenditure of energy, but it is difficult to see why such small vertebrates as pike and carp should live as long as elephants, or toads as long as horses (40 years).—Adapted from the German of Prof. E. Korschelt in Die Umschau.

The year 1907 will see more railway mileage constructed in Ontario and Quebec than in any year since the original lines were built between Montreal and Toronto. The Canadian Pacific Railway intends constructing almost an entirely new line from Montreal to Toronto. The Mackenzie and Mann Syndicate has also important projects in eastern Ontario and in the vicinity of Montreal which will enable it to secure the shortest route between Ottawa and Montreal. The Canadian Pacific will complete the Toronto and Sudbury branch and the Guelph and Goderich Railway. The Grand Trunk Railway will be particularly active in the western section of Ontario between Toronto and Windsor, but the chief work will be rather in the western provinces in building the Grand Trunk Pacific Railway. The Delaware and Hudson will complete its line along the south shore of the St. Lawrence to Quebec.

THE AERO CLUB DINNER.

The first dinner of the Aero Club of America was held at the St. Regis Hotel on the evening of March 14. One of the principal events of the evening was the reading of a letter from the Wright Brothers, in which they gave their ideas on the subject of the large prize for an aeroplane flight to be offered in the near future by the club. The Wrights thought that this prize should be not too difficult of attainment, in order that it should spur on inventors to try and win it. They also stated that they hoped to make some more flights this year, and that if they did, although the flights might not be in public, they would "effectually remove all question that the flying art originated in America."

Another interesting feature of the evening was a description given by E. B. Bronson of a dirigible balloon made of three parallel cigar-shaped gas bags in 1863 by Dr. Solomon Andrews, of Perth Amboy, N. J. This machine, propelled at high speed by some mysterious power, is said to have flown successfully in September of that year.

Announcement was made of the entries for the Bennett International Balloon Race, as follows: France, 3 balloons; Great Britain, 3; Germany, 3; Spain, 3; Italy, 2; and America, 3. The race this year, on October 19, promises to be very interesting.

STEAM TRAP WITH WATER METER ATTACHMENT.

A steam trap has recently been invented which not only operates in a very efficient manner to discharge the water of condensation from a steam pipe or system, but serves, as well, to measure the quantity of water discharged. The trap comprises a cylindrical tank and a narrow rectangular casing connected thereto. In the tank is a float, which is shown in dotted lines in the engraving. The float rod is secured to a rock-shaft that projects from the casing through a stuffing box. The outer end of the rock-shaft carries an arm provided with a counterweight at its upper end and having, at its lower end, a toothed segment. Meshing with the latter is a segment gear wheel, mounted to rotate freely on the shank of a valve head. The valve, which is of the three-way type, governs both the inlet and the discharge pipes of the trap. A square stem projecting from the valve-head shank carries a short arm, to the outer end of which a spiral spring is secured. The opposite end of the spring is fastened to a pin carried by the segment gear wheel. In operation, as the water of condensation accumulates in the tank, the float rises and, by means of the toothed segment, revolves the gear wheel and with it the pin to which the spiral spring is secured. The valve, however, remains at rest, being held by the spiral spring. When a predetermined level of water is reached, the spring is carried by the revolution of the gear wheel past the center or axis of the valve-head, and it then quickly retracts, turning the valve to close the inlet and open the discharge pipe. As the water pours out of the tank the float falls, and the gear wheel is turned in the opposite direction, carrying the spring past the axis again, but in the opposite direction, and returning the valve quickly to its first position. A counting mechanism is secured to the casing, in position to be struck by the segment arm just before each discharge. As the same measure of water flows out each time, the counter serves as a meter, showing the total quantity of water that has passed through the trap. A patent on this trap has been secured by Mr. Alfred L. Riggs, of Ebensburg, Pa.

STEAM TRAP WITH WATER METER ATTACHMENT.

Bennett International Aeronautic Cup Race. The second annual contest will start from St. Louis on October 19th. This contest is open to all kinds of flying machines as well as to free and dirigible balloons, but the contestants must be entered by a club belonging to the International Aeronautic Federation. Each country can have three representatives. The winner is the balloon or flying machine that covers the longest distance.	$2,500 (Trophy)
The "Daily Mail" Prize for an Aeroplane Flight from London to Manchester, England, 161½ Miles. This contest is now open to members of any recognized Aero Club. It is for heavier-than-air machines, preferably aeroplanes. Contestants must start from a point within 5 miles of the "Mail's" London office and land within 5 miles of the Manchester office. More complete rules have not been formulated as yet, but it is probable that the contestants will be allowed to stop and replenish fuel. Santos Dumont has offered a gold medal to the winner, J. N. Griffiths a challenge cup, and the Adams Mfg. Co., $10,000 provided the entire machine is made in England. "The Autocar" will give $2,500 more to the winner if a British-built engine is used. "The Car" offered $25 a mile for every mile covered, with a minimum of 25 miles.	$50,000 10,000 2,500 625
The "Matin" Prize for a Flight by Any Type of Aerial Craft from Paris to London, 217½ Miles. $20,000 of this prize was given by the Paris "Matin," the balance being made up by three patriotic Frenchmen. This prize will be given to the owner of any airship or flying machine, that, propelled by its own power through the air, reaches London within 24 hours from the time it left Paris, the only condition being that the machine be of French construction throughout. The date set for the start of this race is July 14th, 1908, and the second Sundays in August, September and October following if the prize is not won on that day. Stops for replenishment of fuel will be allowed. The point of arrival will be determined by the dropping of a sandbag within a circle 150 feet in diameter.	$50,000
"Société des Bains de Mer d'Ostend" Prize for a Flight by Any Type of Flying Machine from Paris to Ostend, 186 Miles. This contest is open to all, the only condition being that the distance must be covered within 24 hours. Sunday, August 11th, and the Sundays following are the dates set. The Ruinart Père & Fils Prize for the First Aeroplane to fly across the English Channel from Cape Gris-Nez to Dover.	$40,000 2,500
The Henri Deutsch de la Meurthe Prizes and Trophy for Three Flights Around a 124.2-Mile Circuit. This trophy is valued at $2,000. $4,000 cash will be given annually to the winner each year. The contest is open to members of clubs recognized by the International Aeronautic Federation, and the trophy is to be contested for between March 1st and October 31st. It can be won from the holder only by making the circuit at 1/10 higher speed than he made. The third holder of the cup can retain it permanently.	$2,000 (Trophy) $12,000
The Brooklands Automobile Racing Club Prize for a 3-Mile Flight Above the Track. This prize is open to all. It will be given to the first heavier-than-air machine that makes a circuit of the new Weybridge track at a speed of 10 miles an hour or over and at a height of 40 or 50 feet from the ground. This course is open to experimenters for practice.	$12,500
The Deutsch-Archdeacon Prize for an Aeroplane Flight of 1 Kilometer (0.621 mile) in a closed circuit.	$10,000
The Archdeacon Cup for a Flight of 220 Meters (721¾ Feet). This cup was won by Santos Dumont on November 12th last. It must be won two years in succession in order to be retained.	$600 (Trophy)
The "Daily Mail" Model Aeroplane Competition. This competition will be held from the 6th to the 13th of April in the Royal Agricultural Hall, London. The models must not weigh over 50 lbs. complete, and they must fly 50 feet in a straight line with an elevation above ground at the start of 5 feet. Full particulars can be had from the Secretary of the Aero Club, 166 Piccadilly, London, W. 1st Prize, $550; 2d, $375; 3d, $125.	$1,050
"The Car" Prize (Annual) for the Longest Flight Made in England With an Airship or Flying Machine.	$2,500
The Barnum & Bailey Prize for an Aeroplane That Will Fly and Carry a Man.	$10,000
The "Daily Graphic" Prize for a Flight of One Mile.	$5,000
The Pepin Prize for a Heavier-than-Air Machine. Conditions not yet announced.	$200
The Lahm Cup. Offered by the Aero Club of America to members of any aero club in the world for longest distance above 400 miles covered by balloons or any kind of flying machine in the United States.	$1,500 (Trophy)
The Aero Club of America Prize for an Aeroplane Flight. Conditions and prize to be announced later.	$100,000
The Frank Hedges Butler Challenge Cup. For the longest distance covered by aeroplanes or balloons starting from London on some date not yet set.	
Sir David Solomon's Cup for a Heavier-than-Air Machine.	
Lord Howard de Walden Prize for a Heavier-than-Air Machine.	
Total	$315,475

INTERNATIONAL AERONAUTICAL PRIZES OFFERED UP TO DATE.

A New British Heavy Gun.

The British Admiralty is engaged in the production of a new type of heavy gun to constitute the main aggressive armament of the first-class battleships that are shortly to be laid down in accordance with the naval shipbuilding programme that has recently been revised. In this class of warship it is probable that the 12-inch weapon will be abandoned in favor of the new and heavier gun that has been projected. The recent gunnery trials with the "Dreadnought" have confirmed the prevailing theories that it is impossible to render this class of warship more powerful by the addition of further 12-inch guns, since the battery as it at present stands represents the maximum number of guns that can be brought to bear in action with any distinct advantage. Consequently, it is realized that to increase the offensive power of the vessel, a new type of gun of greater caliber is essential.

It is stated that the new weapon will be 13.5 inches, of 45 calibers. A weapon of this caliber is already in use upon the "Royal Sovereign," but its design does not coincide with the modern gunnery practice as applied to weapons of this class, since its penetrating power and velocity are less than the present 12-inch weapon, though the weight of the shell is 1,250 pounds as compared with the 850-pound shell fired from the modern 12-inch weapon. The new 13.5-inch weapon will be 50.625 feet in length, and will weigh approximately 85 tons. The main fighting armament will probably number the same as carried on the "Dreadnought," namely, eight, and so disposed that six can fire ahead or astern, and the whole eight brought to bear upon either broadside.

FILTER FOR COFFEE POTS.

Pictured in the accompanying engraving is a filter of very simple and inexpensive design, which is adapted for use in coffee pots to retain the coffee grounds. The filter proper consists of a bag of thin material, such as muslin, which is so mounted that it can readily be removed, cleaned, and replaced in the coffee pot. The filter bag is supported in the coffee pot on a stand consisting of a tubular body, to which three wire legs are soldered. The filter bag fits within the tube, but at the top it is folded outward over the upper edge of the tube. A cover piece, also of muslin, is laid over the top of the bag, and its edge as well as that of the bag is clamped against the tube by means of a snugly-fitting band. In use, ground coffee is placed in the bag, and the latter, with the stand, is then lowered into the coffee pot. Boiling water is now poured into the pot, or it is filled with cold water and then brought to a boil, and the water will percolate through the bag, extracting the strength from the coffee. In cleaning the bag it is only necessary to withdraw the band to release the edges of the bag and cover. The cover is an important feature, in that it admits of the passage of steam through the top of the bag, but prevents the coffee grounds from getting into the pot, as, for example, by the coffee boiling up over the top of the bag. The inventor of this improved filter is Mr. Clarence Monroe, of Loveland, Col.

FILTER FOR COFFEE POTS

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

COMBINED SOUNDER AND RESONATOR.—S. F. COX, Sallisaw, Ind. Ter. This invention relates to telegraphic apparatus, the more particular object being to produce a combinational instrument adapted to do the work of a relay, a sounder, and a resonator. Further it relates to details of construction, the purpose of which is to improve the general efficiency of the same in the matter of producing a clear tone and of rendering certain parts readily accessible.

TROLLEY HARP.—C. HIBBARD and W. HIBBARD, Sandy Hill, N. Y. In this case the invention refers to trolley-harps, the more particular purpose being to provide means for mounting the trolley-wheel upon the harp and for removing it therefrom, and also for maintaining the wheel mountings firmly in position while the wheel is in place.

ELECTRICAL SIGNAL CONTROL.—M. ABT, New York, N. Y. In the present patent the invention has reference to electric signal controls, and more particularly to a system for use in connection with elevators for the purpose of enabling passengers to hail cars and for apprising passengers of the approach of the said cars.

ELECTRIC MOTOR.—D. MENDELSON, Brooklyn, N. Y. The invention is in the nature of a motor of the vibratory type designed, chiefly, to be used in small installations for advertising purposes, but applicable also to other uses; and it consists in the construction and arrangement of the motor parts with special reference to securing a large effective power in a relatively small motor.

Of Interest to Farmers.

CONVERTIBLE FORK AND RAKE.—C. C. TYLER, Anneta, N. C. Mr. Tyler's improvement relates to a tool adapted to serve as a fork or rake and to be readily converted from one form to the other, and has for its object to provide a tool so constructed as to enable straight prongs to be used and adapted to hold straw or hay when used as a fork as readily as if the prongs were curved, and thereby dispense with disadvantages arising from the use of curved prongs on a tool of this character when used as a rake.

STALK-PULLER.—C. R. SMITH, Fentress, Texas. One purpose of the invention is to provide a machine by means of which a pull may be exerted on stalks for extracting them and their roots and to improve upon the pulling-machines for which Letters Patent were formerly granted to Mr. Smith, to the extent that the machine is made lighter, and wherein the grippers constitute links of endless chains having guided movement in independent casings, the opposing chains being in close and automatically-adjusted relations to each other throughout the length of their inner leads.

CORN-HARVESTER.—J. HETTRICH, Grand Island, Neb. The machine is guided by a grain-wheel on the tongue so that three rows of corn are engaged by the front thereof, dividing boards straightening the leaning stalks. Teeth receive the stalks between them, distance between the teeth allowing the stalk to pass, but not the ear, the latter being snapped off and carried upward by the teeth which deliver onto the carrier. The carrier elevates the ears and drops them onto husking-rollers. Husk is torn from the corn by the rollers and dropped upon the husk-conveyor which delivers it to the rear of the machine, means then provide for dropping the corn into the wagon.

Of General Interest.

MUSIC-SHEET.—J. B. WALKER, New York, N. Y., and A. R. BOND, Plainfield, N. J. A music-sheet used on piano players consists of a length of paper provided with perforations variously arranged according to the notes to be sounded and which is adapted to be moved over a series of pneumatic ducts in a so-called "tracker-board,", to progressively uncover, by means of the perforations, certain of said ducts thereby pneumatically selecting the notes which are to be struck by the mechanism. As heretofore made such sheets expand and contract with hygroscopic changes and do not properly "track" with the tracker board. The present invention provides a sheet which will properly track regardless of atmospheric changes.

ERASER.—G. W. PARK, Denver, Col. One of the principal objects of the improvement is to provide an eraser combined with or forming part of the tubular member ordinarily employed with fountain-pens for protecting the pen or writing-point thereof. The device may be conveniently associated with a fountain-pen and carried in the pocket with the latter to be available for use.

ROLL-PAPER HOLDER AND CUTTER.—J. F. FINAN, Cumberland, Md. The improvement pertains to that form of a roll-paper holder having a stand with a vertical spindle on which the roll of paper is held, and it is designed to apply to this form of roll-paper holder a feature heretofore employed in horizontal roll-paper holders for facilitating the seizure of the edge of the paper between the thumb and forefinger preparatory to pulling it out and tearing off the sheet.

ROPE-GRAB FOR OIL OR OTHER DRILLED WELLS.—L. STEPHENS, Macksburg, Ohio. The invention is an improvement in devices employed for fishing out or recovering ropes lost in oil wells. It is more particularly an improvement in that class of grabs consisting of opposing jaws, which are provided interiorly with teeth and movably connected in such manner that they will close upon a rope and hold it firmly gripped so that it may be drawn out of the well.

SHAFT-PACKING.—F. T. NOLAN, Crystal River, Fla. The object of the invention is to provide a packing for rotatable shafts which is air and water tight and in which there is the minimum amount of friction. The improved packing may be used in connection with rotatable shafts which are already provided with packing-glands.

GRADER.—J. BAGLEY, Tacoma, Wash. The invention is especially useful in connection with devices intended for operation in hard ground, such as shale. The object is to provide a grader which presents a plurality of blade edges. A further object is to provide removable teeth for a device peculiarly adapted for use in hard or stony ground.

SPRINKLER.—C. C. RHODES, Honolulu, Ter. Hawaii, and H. G. RHODES, San Francisco, Cal. In this instance the invention refers to sprinkling apparatus, and more particularly to that adapted for use in watering lawns and the like. It has for its principal object the provision of a movable sprinkler in which the direction of rotation is automatically reversed and in which the range of this movement may be varied.

LABEL SPREADER.—G. N. BYL and J. KOEHLER, Jersey City, N. J. One purpose of the invention is to provide an economic device for spreading labels on a surface coated with an adhesive material, which device can be adjusted to receive labels of varying width and length, and wherein the labels will be held in separate groups or packages, and wherein also the feed of the labels will be automatic and reliable.

SHAFT-PACKING.—C. H. COOK, Louisville, Ky. This invention refers to improvements in packings particularly designed for automobile piston-shafts, an object being to provide a packing that will permit the slight vibratory motion incident to piston-shafts, but will effectually prevent leakage along the shaft of gas or other motive agent employed.

COMPOSITION OF MATTER.—E. VOLLER, Jersey City, and M. F. THALBERG, Hoboken, N. J. The composition is adapted for any purpose for which a hard waterproof and fireproof material is desired; but it is particularly adaptable for use as a lining for ceilings, walls, and the like. While the material is being formed any suitable coloring matter may be introduced to produce the color or tint desired for the resulting product.

SIGN-PAINTING PROCESS.—T. MUNNECKE, New York, N. Y. The invention has reference to a process for painting signs or fixing characters upon a surface. The improvement is especially applicable in placing signs or letters upon glass, as in show-windows or glass doors, the object being to facilitate the object.

METHOD OF TREATING ORES.—W. KEMP, Tucson, Arizona Ter. Mr. Kemp's invention relates to an improved method for smelting ores, especially ores of copper and iron. This inventor does not limit himself to the use of any particular apparatus for carrying out his process. Certain particular forms of apparatus are especially suited for this purpose. While feeding fuel to the ore continuously he also prevents premature combustion from taking place in the fuel supplied.

HAWSE-PIPE. — C. PETRIE, St. Johns, Newfoundland. The principal objects of the invention are to provide means whereby a cable will be absolutely protected from coming into contact with any sharp edges and to provide rollers for reducing friction and assisting in the above-named objects with means whereby if the spindles are broken or displaced they will still remain in position and perform their services in a similar manner to that in which they operate normally.

Hardware.

LOCK.—T. S. MORTON, Quincy, Ill. The improved lock comprises a casing, a sliding latch, and a gravity member made approximately T shape and pivoted in the middle of its head and below the pivotal connection of the same with the latch, its pendent portion extending below the pivot and below the plane of the lateral arm.

COMBINED TURNING-TOOL AND CALIPERS.—R. S. WHIPPLE and J. A. OLESSAK, Philadelphia, Pa. The object of the invention is the provision of novel details of construction for a wood-turning tool and for a caliper attachment thereon that are adapted for cooperative use, affording a gage as well as a turning-tool, whereby a piece of material may be rapidly turned to a desired diameter at one operation.

Household Utilities.

WINDOW-JACK.—J. S. HAWLEY, New York, N. Y. The jack is designed for prying up windows which become stuck by reason of the swelling of the sash or other causes. The invention consists of a lever with a reduced end adapted to work in a recess in the lower frame of the window-sash and carrying fulcrum-blocks of different heights at opposite sides thereof, adapted to be brought alternately in action.

COFFEE AND TEA FLASK.—J. GARRIGAN, New York, N. Y.—The aim in this invention is to provide a heating device with means for removably holding it in position; also to provide the flask with a center draft-tube down which air is drawn to cause the lamp-flame to spread over the bottom of the flask, thus causing quick heating of the liquid. The term flask is designed to also cover dinner-pails or other vessels.

DISH-DRAINER.—J. P. TIBBITS, New York, N. Y. This device is used for holding plates, saucers, and other dishes in such position as to allow the same to drain thoroughly and makes an excellent dish-warmer. The invention also relates to a type of rack in which dishes are as far as practicable supported edge upward, yet rest easily in position without any pressure except that due to their own weight, and suspended clear of the bottom of the drip-tray in such manner that the entire edge of each dish is free.

Machines and Mechanical Devices.

ATTACHMENT FOR GRINDING CENTERS.—C. L. PETRIKIN, Muncy, Pa. The grinder is especially designed to be applied to lathes. One embodiment of the invention consists of a frame substantially U-shaped supported in horizontal diagonal position from the tail-stock spindle when applied to the lathe, a form of clamp being employed adapting the frame to be readily attached and detached. Journaled in the frame extremities is a shaft frictionally driven from the lathe face-plate and itself acting to frictionally drive a second shaft, journaled parallel thereto in the frame, the second shaft carrying a grinding-wheel at its inner extremity and slidingly mounted in its bearings, whereby the wheel may be reciprocated over the lathe-center as both revolve in opposite directions.

REWINDING MECHANISM FOR SELF-PLAYING PIANOS.—H. MEYER, New York, N. Y. The object of this invention is to provide a mechanism arranged to allow the use of a single note-sheet containing a number of pieces of music, only one of which is played upon the introduction of a coin, the note-sheet being automatically rewound at the end of the last piece of music to start playing the first piece of music upon the introduction of another coin. It is a division of the application for Letters Patent of the United States, formerly filed by Mr. Meyer.

NAIL AND RIVET MACHINE.—J. BUCKLEY, Waterbury, Conn. The chief objects of the inventor are to provide a multiplex machine which can be used for simultaneously making a plurality of rivets, nails, and the like, and in which portions can be readily thrown out of gear by a simple manipulation of the parts, so as to provide for making any smaller number of articles. In this way the machine can be used for making a single rivet at a time or for simultaneously making a nail and a rivet or a plurality of either.

BAND-CUTTER FOR THRESHING MACHINES.—M. G. ALBERTSON, Oakes, N. D. One object of the invention is to provide automatically-acting friction-brakes which operate upon shafts to prevent them from turning during the time the knives are in normal operation, said brakes being so applied that should rapidity of the feed of the bundles tend to choke the machine the brakes will permit the knife-carrying shafts to revolve and their knives to roll over the bundles, thus obviating throwing off the drive-belt and preventing possible breakage of knives.

MACHINE FOR CLEANING AND SEPARATING COTTON FROM ITS IMPURITIES.—J. S. LYLE, McLoud, Oklahoma Ter. A special object in this instance is to provide a machine which will act upon cracked and unopened bolls, and so work upon machine-picked material, as well as hand-picked, thereby reducing the cost of gathering the cotton and increasing the yield by utilizing immature and unopened bolls. Such bolls are opened without cutting or tearing the same, thereby saving the staple and avoiding the difficulty of cleaning out mashed or finely-broken pieces of hulls.

MOLDING-MACHINE. — H. BANNON, Elwood, Indiana. This machine is especially adapted for molding chimney-blocks having smoke and ventilating passages. It is capable of general use. A hand-press made of cast-steel provides great strength without clumsiness, and can be operated by an attendant to mold articles of complicated shape and leave them so as to be readily removed from the mold and set aside for drying. The invention also provides an efficient and easily-operable core-manipulating device, a simple means for opening the mold, a novel press-head, and a pallet.

VIOLIN-PIANO.—F. H. WATSON, Huntingdon, Tenn. In this patent the object of the invention is to provide a violin-piano which is simple and durable in construction and arranged to insure the proper sounding of the treble and bass strings and to allow of conveniently placing the resinous band in position.

INTESTINE-CLEANER.—W. F. DUNCKER, Wrightsville, Pa. Mr. Duncker's invention consists in an improvement in machines for cleaning intestines of hogs, beef, and sheep for casing of sausage, etc. Injury to the casings or tearing thereof by the revolution of scrapers is avoided in the operation. The feed-rollers and scrapers are kept clean and water is supplied to wash the casings as they are passing through the machine.

Prime Movers and Their Accessories.

MOTOR.—S. J. EVANS, Bluefield, W. Va. In this case the invention has reference to motors, and has for its object the provision of a motor which is simple, cheap, and efficient in operation, and one in which the water of condensation is drained off without the use of cocks. Air may be employed as a motive fluid instead of steam, if desired.

LUBRICATOR.—C. G. GLASRUD, Sheyenne, N. D. This force-feed lubricator is adapted to be applied to connecting-rods and other moving parts of engines or other machinery. It insures certain and reliable action, at the same time provides means by which the feed may be regulated with great exactness. The driving part is simple and certain in action, and provides for complete regulation of its movement.

Railways and Their Accessories.

BRAKE MECHANISM FOR INCLINED RAILWAYS.—S. E. JACKMAN, New York, N. Y. The object of this invention, which relates to mechanisms for inclined railways, such as shown and described in Letters Patent of the United States, formerly granted to Mr. Jackman, is to provide a mechanism, arranged to allow the controlling of a car on the down-track or homestretch independent of the occupants and with a view to check the speed of the car and bring it finally to a stop at the station.

RAILWAY.—S. E. JACKMAN, New York, N. Y. The invention relates to switch-back or inclined gravity railways—such as are used in pleasure-resorts, exhibitions, and the like. The object is to provide a railway arranged to afford exciting and interesting rides over a continuous track. Very little time is consumed in passengers entering and leaving the cars. Mr. Jackman has secured two more patents in railways. In one, the invention refers to switch-back or inclined gravity-railways, and is for use in pleasure resorts, exhibition-grounds, etc. The arrangement provides for cars continually traveling over a continuous track, with little loss of time in handling passengers, and hence many cars can be run simultaneously on the track, spaced suitable distances apart, and a revenue can be derived from the running in a comparatively short time. Mr. Jackman's next invention of a railway relates to switch-back or gravity railways, such as used in pleasure-resorts, exhibition-grounds, and the like places. The object is to provide a railway having a continuous track for cars to travel on, the track being provided with deep dips in the several courses to render the ride exceedingly interesting and exciting to the passengers.

COMBINED TRAIN SIGNAL AND INDICATING APPARATUS.—W. A. HARRIS and B. A. HARRIS, Greenville, S. C. The apparatus is especially designed for use on passenger-trains and adapted through the aid of an independent train-pipe to communicate an audible and a visual signal to the engineer, the visual corresponding to the audible and remaining in position to indicate the latter signal which has been given until the indicating devices have been released by the engineman. The Messrs. Harris have invented another combined train signal and indicating apparatus designed for use on freight trains, the present invention relating to means whereby the engineer may signal back to the conductor or other train man in the caboose the signals which have been received by the engineer or any other signal desired, the objects being to establish signaling communication by which signals may be reliably sent back and forth between the caboose and engine-cab.

CAR-REPLACER.—W. A. HUTSON, Orlando, Fla. The replacer is of the class which consists of a portable device, commonly called a "frog" or "shoe," which is adapted to be placed over or beside a track rail and has a grooved and sloping guideway in which a truck-wheel of a railroad-car may run and be at the same time guided into due normal position upon the rail. It includes two frogs or shoes, which are used together, but differ in construction, the same coacting in such a way as to replace a car-truck in a novel and expeditious manner.

Pertaining to Recreation.

GUN-SIGHT.—D. W. KING, JR., San Francisco, Cal. The purpose here is to provide a sight in which are means whereby to enable a marksman to use any one of the four notches with either side of the diaphragm at any desired elevation, providing for eight combinations, and giving him a rear sight to suit the eyes and to conform to the size and shape of the front sight used and also to render the sight adaptable to various conditions of weather, light, or background.

GAME DEVICE.—H. D. DARLINGTON, Norwood, Ohio. One purpose of the inventor is to provide a device which embodies a game-board provided with numerically-designated counting-spaces having electrical connection with a signaling device and a co-operating expelling device adapted for throwing a ball, projectile, or

other object onto a table from a point remote therefrom, the object thrown having a contact portion to complete the electric circuits employed.

Pertaining to Vehicles.

HORSE-DETACHER.—H. G. Simpson, Elkhorn, W. Va. This is an attachment for the front axles of carriages and wagons for releasing poles and shafts in case of danger from a horse or team running away. More particularly it is an improvement in detachers which include sliding bolts adapted to secure pole or shaft irons, and a vertical oscillating lever with which such sliding bolts are connected by links or rods.

CARRIAGE-TOP ATTACHMENT. — W. C. Willitts, Eckford, Mich. This inventor's improvement is in that class of buggy or carriage top attachments which are removable from the carriage or buggy seat. The object is to provide an attachment which may be more easily and quickly applied and detached than heretofore and which will be held securely when so applied. It is applicable for many forms of vehicles.

CHECK ATTACHMENT TO VEHICLES.—S. L. Duckett, Goldfield, Colorado. Of the purposes in this instance one is to provide an attachment adapted for use in checking horses should they attempt to run away while being driven or when left standing and to provide a device for such purposes which will be simple and which can be brought into action while the driver still holds the reins.

CRANK-HANGER.—F. M. Osborne, Anaconda, Mont. This invention is an improvement in crank-hangers for bicycles. In carrying out the invention the sprocket wheel pulls between the bearings, and the cranks can be conveniently removed when desired without disturbing all of the parts of the hanger. The construction forms a very simple crank-hanger from which dust will be excluded and in which the cranks can be readily removed by simply turning off a nut and pulling the shaft-sections of the cranks apart.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(10440) Mr. C. D. W. asks: Is John Tyndall dead? If so, when did he die? A. John Tyndall died December 4, 1893.

(10441) S. K. S. says: Is the nebular hypothesis of Laplace still the accepted scientific theory of the cosmogony of our castle? If not, what theory, if any, has supplemented it? A. It cannot be said that the nebular hypothesis of Laplace is held in its entirety by astronomers at the present time. The phenomena which cannot be accounted for by their conditions are too numerous. Darwin's tidal evolution hypothesis has by many been adopted as an addition or supplement to the nebular hypothesis. The large number of spiral nebulæ seem to demand a modification of the hypothesis. You will find a very recent exposition of the whole question in Moulton's "Astronomy," pp. 440-448. We can send the book for $1.25. It is the latest text book of astronomy.

(10442) W. B. K. asks for the government formula for whitewash. The following coating for rough brick walls is used by the United States government for painting lighthouses, and it effectually prevents moisture from striking through: Take of fresh Rosendale cement, 3 parts, and of clean, fine sand, 1 part; mix with fresh water thoroughly. This gives a gray or granite color, dark or light, according to the color of the cement. If brick color is desired, add enough Venetian red to the mixture to produce the color. If a very light color is desired, lime may be used with the cement and sand. Care must be taken to have all the ingredients well mixed together. In applying the wash, the wall must be wet with clean fresh water; then follow immediately with the cement wash. This prevents the bricks from absorbing the water from the wash too rapidly, and gives time for the cement to set. The wash must be well stirred during the application. The mixture is to be made as thick as can be applied conveniently with a whitewash brush. It is admirably suited for brickwork, fences, etc., but it cannot be used to advantage over paint or whitewash.

(10443) A. A. H. asks how to make javelle water. A. Javelle water proper is prepared by passing gaseous chlorine—derived from the action of hot sulphuric acid on a mixture of common salt and oxide of manganese—into a 10 per cent aqueous solution of carbonate of potash until the latter will absorb no more. It may also be made by adding a solution of carbonate of potash to a solution of chlorinated lime (bleaching powder) as long as a precipitate continues to form, the liquid being afterward decanted or filtered. Ordinarily, however, the liquid called javelle water is chlorinated soda, and not potassa.

(10444) J. K. B. asks how to make gravel and tar walks. A. Take 2 parts very dry lime rubbish and 1 part coal ashes, also very dry, and both sifted fine. In a dry place, on a dry day, mix them, and leave a hole in the middle of the heap as bricklayers do when making mortar. Into this pour boiling hot coal tar, mix, and when as stiff as mortar put in 3 inches thick where the walk is to be; the ground should be dry and beaten smooth; sprinkle over it coarse sand. When cold, pass a light roller over it; in a few days the walk will be solid and waterproof.

(10445) B. L. W. asks how to make Pharaoh's serpents. A. These are little cones of sulphocyanide of mercury which, when lighted, give forth a long, serpent-like, yellowish brown body. Prepare nitrate of mercury by dissolving mercury dioxide in strong nitric acid as long as it is taken up. Prepare also sulphocyanide of ammonium by mixing 1 volume sulphide of carbon, 4 strong solution of ammonia, and 4 alcohol. This mixture is to be frequently shaken. In the course of about two hours, the bisulphide will have been dissolved, forming a deep red solution. Boil this until the red color disappears and the solution becomes of a light yellow color. This is to be evaporated at about 80 deg. F., until it crystallizes. Add little by little the sulphocyanide to the mercury solution. The sulphocyanide of mercury will precipitate; the supernatant liquid may be poured off, and the mass made into cones of about ½ inch in height. The powder of the sulphocyanide is very irritating to the air passages, and the vapor from the burning cones should be avoided as much as possible. To ignite them set them on a plate or the like, and light them at the apex of the cone.

(10446) H. N. M. asks how to prepare skins for fur. A. Mix bran and soft water sufficient to cover the skins. Immerse the latter and keep them covered for twenty-four hours; then remove, wash clean, and carefully scrape off all flesh. To 1 gallon of water (hot) add 1 pound of alum and ¼ pound of salt. When dissolved and cool enough to admit entrance of the hand, immerse the skins for twenty-four hours, dry in the shade, and rub. Stir the liquor again, immerse the skins for twenty-four hours, dry, and rub as before; immerse for twenty-four hours in oatmeal and warm water, partially dry in the shade, and finally rub until entirely dry. This leaves the skin like white leather, and fit for immediate use.

(10447) A. C. N. asks how to lay sheet lead. A. In laying sheet lead for a flat roof, the joints between the sheets are made either by rolls, overlaps or soldering. In joining by rolls, a long strip of wood two inches square, flat at the base and rounding above, is placed at each seam; the edge of one sheet is folded round the rod and beaten down close, and then the corresponding edge of the next sheet is folded over the other. In over-lapping, the adjacent edges of the two sheets are turned up side by side, folded over each other and closely beaten down. Soldering is not adopted when the other plans can be carried out.

(10448) H. J. N. asks how putz pomade is made. A. 1. In 100 pounds common yellow vaseline, melted, stir 20 pounds of fine colcothar. 2. Same as above, only using lard instead of vaseline. 3. Twenty pounds of Am. mineral oil and 5 pounds of lard are melted and 25 pounds of fine colcothar are stirred in. 4. The following is given as the formula for genuine puts pomade: Oxalic acid, 1 part; oxide of iron, 25 parts; rottenstone, 20 parts; palm oil, 60 parts; vaseline, 4 parts. The oxide of iron may be Venetian red. Both it and the rottenstone must be absolutely free from grit. Oxalic acid is poisonous.

(10449) M. B. W. asks how to make dextrine paste. A. In hot water dissolve a sufficient quantity of dextrine to bring it to the consistency of honey. This forms a strong adhesive paste that will keep a long time unchanged, if the water is not allowed to evaporate. Sheets of paper may be prepared for extempore labels coating one side with the paste and allowing it to dry; when to be used, by slightly wetting the gummed side, it will adhere to glass. This paste is very useful in the office or laboratory.

(10450) H. P. W. asks how to join rubber. A. Rubber is easily joined and made as strong as an original fabric, by softening before a fire, laying the edges carefully together, without dust, dirt, or moisture between. The edges so joined must be freshly cut in the beginning. Tubing can be united by joining the edges around a glass cylinder, which has previously been rolled with paper. After the glass is withdrawn the paper is easily removed. Sift flour or powdered soapstone through the tube to prevent the sides from adhering from accidental contact.

(10451) C. N. asks for a formula for ground glass. A. Sandarac, 90 grains; mastic, 20 grains; ether, 2 ounces; benzole, ⅓ to 1½ ounce. The proportion of the benzole added determines the nature of the matt obtained.

(10452) A. M. C. asks: I have a system of wires which I use for receiving wireless messages. They are horizontal, and run nearly parallel to the elevated structure of the Long Island Railroad, which is equipped with the third-rail system. I have noticed that unless the weather is damp, whenever a *steam* engine passes on the structure, I get sparks about ⅛ inch long from the wires. There are four wires, each 180 feet long. They run at an angle of about 15 deg. to the tracks, and are about 40 feet off ground. Between the wires and parallel to the tracks is a two-phase 2200-volt alternating line, about the same height as the wires. The least distance from the wires to tracks is about 125 feet. No smoke or steam from engine reaches the wires. The sparks are very heavy, and apparently of an oscillatory nature, not the ordinary static sparks obtained from high wires. At no other times except during thunderstorms can I get sparks from the wires which amount to anything. A. There would seem to be no doubt that the sparks from the receiving wires of the wireless station are due to the induction of the great mass of metal in the steam engine, passing through a field in which heavy currents are already flowing, that of the alternating current. We have not met with just this case before, but it would seem that this cause would be sufficient to account for the effect produced.

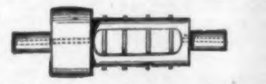
(10453) K. S. B. writes: In regard to the recent wreck of the electric train on the New York Central, I see by your paper that the spikes holding the outer rail were sheared, showing a much greater stress on the outer rail at a given speed than for a steam locomotive of the same weight. As for the reasons for this: Besides the concentration and the low height of the load, would not the gyroscopic effect of the rotating parts of the motors play an important part? As the wheels (drivers) are comparatively small, the speed of rotation is large. Then to change the direction of the axis of revolution of these heavy, rapidly-revolving parts would take a considerable force, which was probably not taken into account by the engineers, who elevated the outer rail to counteract the inertia of the train only. This so-called "gyroscopic action" enters as a large factor in other problems of a similar nature, and it seems to me that it would in this particular case also. It also seems to me that this action of the motors would have to be taken into account on heavy motors at high speeds. I presume that lighter parts, also lower speeds in general, is what has kept electric trains from experiencing this difficulty heretofore. A. Your suggestion of a gyroscopic action in the rapidly rotating wheels of an electric train is doubtless correct. Just how great a force is produced we have not calculated. It would be variable, and would increase very rapidly with the increase of speed.

(10454) E. S. D. writes: Will you kindly answer me through your Notes and Queries what would be the normal height of the barometer at an elevation of 5548 feet above the level of the sea? A. Normal barometer at an altitude of 5,548 feet will be about 24½ inches.

(10455) J. B. W. asks how to color brass a deep blue. A. A cold method of coloring brass a deep blue is as follows: 100 grammes of carbonate of copper and 750 grammes of ammonia are introduced in a decanter, well corked, and shaken until dissolution is effected. There are then added 150 cubic centimeters of distilled water. The mixture is shaken once more, shortly after which it is ready for use. The liquid should be kept in a cool place, in firmly closed bottles or in glass vessels, with a large opening, the edges of which have been subjected to emery friction and covered by plates of greased glass. When the liquid has lost its strength it can be recuperated by the addition of a little ammonia. The articles to be colored should be perfectly clean; especial care should be taken to clear them of all trace of grease. They are then suspended by a brass wire in the liquid, in which they are entirely immersed, and a to-and-fro movement is communicated to them. After the expiration of two or three minutes, they are taken from the bath, washed in clean water, and dried in sawdust. It is necessary that the operation be conducted with as little exposure to the air as possible. Handsome shades are only obtained in the case of brass and tombac—that is to say, copper and zinc alloys. The bath cannot be utilized for coloring bronze (copper-tin), argentine, and other metallic alloys.

(10456) A. D. M. asks for a dressing for linoleum. A. A weak solution of beeswax in spirits of turpentine has been recommended for brightening the appearance of linoleum. Here are some other formulas: 1. Palm oil, 1 ounce; paraffine, 18 ounces; kerosene, 4 ounces. Melt the paraffine and oil, remove from the fire and incorporate the kerosene. Polish.—2. Yellow wax, 1 ounce; carnauba wax, 2 ounces; oil turpentine, 10 ounces; benzine, 10 ounces. Melt the waxes carefully, add the oil and benzine, and stir until cold. 3. Yellow wax, 5 ounces; oil turpentine, 11 ounces; amber varnish, 5 ounces. Melt the wax, add the oil, and then the varnish. Apply with a rag.

(10457) J. W. H. asks for a tool for straightening wire. A. Such a tool is shown in the accompanying cut. It consists of a casting about 10 inches in length, having



on each end a bearing which may be supported in suitable boxes. The pulley is a part of the casting, and is 3 inches in diameter and 2 inches wide. Four steel pins are inserted 1 inch apart and a little to one side of a central longitudinal line. A hole a little larger than the wire to be straightened is drilled axially through the bearing. The wire passes through the tool over and under the steel pins. It is well lubricated and is pulled through as the tool revolves rapidly.

(10458) C. N. asks how to do annealing. A. For a small quantity, heat the steel a cherry red in a charcoal fire, then bury it in sawdust, in an iron box, covering the sawdust with ashes. Let it stay until cold. For a larger quantity, and when it is required to be very soft, pack the steel with cast iron (lathe or planer) chips in an iron box as follows: Having at least half or three-quarters of an inch in depth of chips in the bottom of the box put in a layer of steel, then more chips to fill spaces between the steel and also the half or three-quarters of an inch space between the sides of the box and steel, then more steel; and lastly, at least one inch in depth of chips, well rammed down on top of the steel. Heat the whole to and keep at a red heat for from two to four hours. Do not disturb the box until cold.

(10459) B. W. F. asks how to clean paint. A. To clean paint, provide a plate with some of the best whiting to be had; have ready some clean warm water and a piece of flannel, which dip into the water and squeeze nearly dry; then take as much whiting as will adhere to it, and apply it to the painted surface, when a little rubbing will instantly remove any dirt or grease. After which, wash the part well with clean water, rubbing it dry with a soft chamois. Paint thus cleaned looks as well as when first laid on, without any injury to the most delicate colors. It is far better than using soap, and does not require more than half the time and labor.

(10460) C. D. asks how to make grape syrup. A. 1. Half pint brandy, 1 ounce tincture of lemon, 1 gallon simple syrup, tincture red sanders, 1 quart. 2. Brandy, ½ pint; spirits of lemon, ¼ ounce; tincture of red sanders, 2 ounces; simple syrup, 1 gallon. 3. A grape syrup, not an artificial syrup, or one for fountain use, but a syrup from the fruit, for domestic or table use, etc. Take 20 pounds ripe freshly picked and selected tame grapes, put them into a stone jar, and pour over them 6 quarts of boiling soft water; when sufficiently cool to allow it, well squeeze them thoroughly with the hand, after which allow them to stand 3 days on the furnace with a cloth thrown over the jar, then squeeze out the juice and add 10 pounds of crushed sugar; let it remain a week longer in the jar; then take off the scum, strain and bottle, leaving a vent until done fermenting, when strain again and bottle tight, and lay the bottles on the side in a cool place.

(10461) B. J. asks how to waterproof canvas. A. A solution containing equal parts by weight of gelatine and chrome alum. It is not advisable to mix more of the solution at once than is sufficient to give the canvas one coat, as, if the mixture once sets, it cannot be reliquefied like a plain solution of gelatine, and hence, if the quantity of canvas to be waterproofed is but small, it would, perhaps, be preferable to coat with plain gelatine solution until quite impervious to cold water, and then to thoroughly soak for, say, twenty-four hours in a strong solution of chrome alum.

NEW BOOKS, ETC.

The Naval Pocket-Book. Founded by Sir W. Laird Clowes. Edited by Geoffrey S. Laird Clowes. London: W. Thacker & Co., 1906. Pocket size; pp. 965. Price, $3.

The present edition of this well-known, compact, and very convenient little work is fully up to the high quality of its predecessors. It opens with a calendar in which the leading events of naval history on each particular date are recorded; and this is followed by a comparative summary of the fighting fleets of the world arranged under a new system of notation. Then in tabular form is given the statement of the various world's navies, tables and descriptions of the naval guns and small arms, a list of drydocks, giving dimensions and capacities, and at the close of the book are diagrams of the leading types of ship of each navy, showing the disposition of guns and armor with the sizes and thicknesses of each.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Inquiry No. 8575.—Wanted, manufacturers of swedging machines.

Inquiry No. 8576.—Wanted, the present address of the Unique Manufacturing Company.

Inquiry No. 8577.—Wanted, manufacturers of Jubiter wire cable.

Inquiry No. 8578.—Wanted, manufacturers of small hand shapers for metal.

Inquiry No. 8579.—Wanted, lamps for taking pictures at night, where there is no light.

Inquiry No. 8580.—Wanted, names and addresses of large dealers in excelsior.

Inquiry No. 8581.—Wanted, manufacturers of blasting mats.

Inquiry No. 8582.—Wanted, the present address of the British-American Pitch Company.

Inquiry No. 8583.—Wanted, manufacturers of machinery for making burlap sacks.

Inquiry No. 8584.—Wanted, makers of machines for manufacturing leaden ammunition for shooting purposes, also of machines worked to utilize the waste or refuse of cork from which cork planks for bathing purposes are made.

Inquiry No. 8585.—Wanted, makers of ice machines of about 500 pounds capacity per day.

Inquiry No. 8586.—Wanted, makers of popcorn and peanut wagons, having plate-glass front and rubber tires.

Inquiry No. 8587.—Wanted, manufacturers of drying apparatus, for drying flax straw, having capacity of handling 20 tons of damp material in ten hours.

Inquiry No. 8588.—Wanted, the addresses of manufacturers of tin or aluminum threaded stoppers of 1½ inches diameter, to be soldered on the cans.

Inquiry No. 8589.—Wanted, the name and address of the manufacturer having recently placed paper milk bottles on the market.

Inquiry No. 8590.—Wanted—Name and address of makers of machines for applying Crown bottle stoppers to bottles; machines different to the so-called Baltimore type.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending

March 12, 1907.

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Abrading material, E. F. Landis........ 847,190
Acid receptacle, G. P. Adamson.......... 846,541
Acids, production of organic sulfonic, M. Jijinsky 847,078
Aeroplane or craft for aerial navigation, A. & H. Dufaux.......... 846,830
Air brake system, W. V. Turner.......... 846,528
Air cooling and humidifying apparatus, J. Kelly 847,185
Air in rooms, apparatus for cooling, moistening, and purifying, D. Buhlmann.. 847,232
Alloy and its manufacture, steel, J. Churchward 846,979
Alloy, metal, A. E. Hobson.......... 846,851
Amalgamator and concentrator, J. A. Jean 847,077
Amusement device, G. Kramer.......... 846,925
Amusement device, E. N. Chamberlain.... 847,240
Amusement device, H. F. Crickler........ 847,242
Anchor device, adjustable, W. L. Greeley.. 846,995
Animal head, imitation, W. Stellwagen...... 846,519
Anvil, L. F. Clar.......... 846,548
Apparel hanger and support, W. H. Shaw.. 846,956
Automatic lubricator, A. Pribil.......... 846,507
Automobile, M. H. Sullivan.......... 847,128
Automobile frame, Nicholson & Rude...... 846,599
Automobile horn, I. E. Stump.......... 846,961
Axle lubricating mechanism, H. W. Sanford 847,263
Bailing machine, W. P. Marsh.......... 846,589
Bait and weed guard, artificial, G. W. Upton 847,266
Baling press, H. L. Duncan.......... 846,735
Baling press, W. D. Ivy.......... 847,181
Barrel head linings, making, L. Y. Williams 846,885
Barrel leveling machine, J. S. Oram.846,601, 846,602
Bath sprays and the like, connection for, H. L. Bruen.......... 846,905
Bath tub leg fastening, C. H. Booth...... 846,977
Bearing, antifriction center, J. C. Barber, 846,893, 846,894
Bearing, antifriction lateral motion center, J. C. Barber.......... 846,892
Bearing, ball, L. Burg.......... 846,727
Bearing, fluid pressure thrust, O. Lasche.. 846,927
Bearing, roller, T. Cooper.......... 846,908
Bearing, roller, G. Rennerfelt......847,260, 847,261
Bearing, roller, E. Belknap.......... 847,274
Bearing, shaft, A. H. Kruesi.......... 846,795
Bed pan and douche, combined, N. Egan.. 846,834
Beehive, C. Spierling.......... 846,517
Beet root, etc., treatment of, C. Steffen.. 847,126
Belt and buckle, Hynard & Meehan...... 846,476
Belt stretcher, Eshelman & Thoenen........ 846,786
Belt, waist, W. R. Mulock.......... 846,934
Belting, J. L. Bixby, Jr.......... 847,228
Bicycle package carrier, W. H. Reed...... 846,695
Binder, N. F. Mogland.......... 846,860
Binder, loose leaf, J. B. Barlow.......... 847,039
Bisulphite liquor, apparatus for making, J. C. Murray 846,490
Blind, window, V. Wyss.......... 847,143
Blower, W. W. Green.......... 846,844
Blue printing machine, S. B. Whinery.... 847,034
Blue printing, washing, and drying apparatus, continuous, C. F. Pease.......... 846,941
Bluing, effervescent laundry, Z. S. Yarnall.. 846,887
Boat launching means, life, R. Zolling..... 846,770
Boat plug, G. W. Renton.......... 847,112
Boat, stone, F. C. Rawson.......... 846,617
Boat, submarine torpedo, A. Elgar.......... 846,736
Body brace and hose supporter, J. Cohen.. 846,551
Boiler, E. S. Clark.......... 846,982
Boiler draft regulator, steam, A. J. Snow.. 847,209
Boiler furnace, H. Emerson 846,836
Boiler tube cleaner, J. F. Land.......... 846,856
Book rest and the like, A. Englefield....... 847,052
Boot puller, H. M. Paul.......... 846,694
Boring machine, C. Somers 846,870
Bottle, drop regulating, A. Wilkin.......... 847,218
Bottle or jar and the like, J. Hurlimann.. 847,075
Bottle stopper, A. B. Hamilton.......... 846,467
Bottle stopper, A. W. Cordes.......... 846,909
Bottle stopper, G. Kirkegaard.......... 847,006
Bottle washing machine attachment, W. J. Cunningham 846,983, 847,280
Bottles, non-refillable, device for rendering, V. Clark 846,550
Braiding machine, J. E. Kirberg.......... 847,005
Brake, H. J. Dohrer.......... 846,457
Brake, V. Lamb 846,481
Brake beam, J. B. Barnes.......... 846,819
Brake beam, E. D. Bronner 847,156
Brake shoe, J. J. Newbaker 846,755
Brake shoe, composite, D. O. Ward........ 846,707
Brick machine, T. Sederwall.......... 847,120
Brickmaking plant, H. H. Walsh.......... 846,536
Brooder, W. H. Rogers 846,865
Brush, C. Gamache 847,060
Brush, fountain blacking, W. G. Hoffman.. 847,252
Brush, fountain marking, J. B. Fischer.... 846,558
Brush making machine, W. G. Liebig...... 846,583
Brush, polishing, J. A. Kreag.......... 846,793
Brush, toilet, A. A. Wensinger 848,636
Brush, tooth, W. O. Bloom.......... 846,900
Bucket, dumping, L. A. Lehmann.......... 846,800
Buckle, H. J. Gaisman.......... 846,991
Buckle, W. H. Griffin 847,064
Buckle, L. Sanders 847,118
Buggy top detaching means, C. G. Cook... 846,782
Building block mold, Alexander & Frederickson 847,220
Building material, forming, J. Oltmanns.... 847,202
Bulkhead door, hatch, or other barrier, W. B. Cowles 847,165
Bullet, J. H. Barlow 847,149
Buoy, torpedo, and similar device, W. E. Hill 846,567
Buttermilk substitute, preparing a, A. Sauer 846,697
Button machine, H. J. Skipp.......... 846,806
Button, snap, Iversen & Finsrud.......... 847,253
Cabinet, J. Herzog 846,848
Cabinet, picture, E. E. Viets.......... 846,531
Can heading machine, N. Troyer.......... 846,966
Can opener, Horton & Molesworth.......... 846,921
Candle holder, H. Tartsch..........846,705, 846,706
Cane, F. L. Hall.......... 847,060
Car coupling, A. Berg 846,898
Car door, R. Mobley 846,594
Car door automatic closing device, railway, C. Lehnert 846,675
Car door, flush, R. Mobley.......... 846,595
Car door, grain, B. Daugherty 846,913
Car, dump, T. R. McKnight 846,501
Car fender, N. P. Duncan 846,459
Car fender, J. H. Dixon 847,247
Car fender, street, W. D. Leftwich........ 847,084
Car fender, street, C. B. Mead 847,091
Car, hand, J. H. Taylor 847,030
Car, passenger, W. Voss 847,135
Car, railway, L. J. Harris..........846,846, 846,847
Car, railway freight, W. R. Mulock, reissue 12,615
Car replacing frog, L. Pluard.......... 847,259
Car side bearing, H. D. Laughlin...846,577, 846,578
Car side bearing, H. M. Perry....846,608 to 846,610
Car signal device, street, H. H. Miller.... 847,289
Car stake, F. W. Topliff 846,877
Car stake and attaching means therefor, J. A. Toomey 846,963
Car, tank, T. R. Brown.......... 846,646
Car wheel, T. L. Hawkins.......... 847,069
Carbureter, Mason & Sinclair.......... 846,679
Carbureter, G. H. Holgate 846,852
Carbureter, F. A. Bradbeer.......... 846,903
Cartridge and manufacture thereof, F. I. Du Pont 846,612
Cash carrier, J. F. Hayes.......... 847,070
Cash drawer, N. W. Williams 846,710
Casket handle, reinforced, M. Bremer.... 846,545
Cement and apparatus therefor, burning, H. L. Doherty 846,555
Cement kiln and fuel feeder therefor, rotary, C. A. Matcham 847,257
Cement mixer, J. A. Devine.......... 847,281
Cements, manufacture of waterproof and non-exuding, R. Liebold 847,015
Centrifugal machines, flexible spindle for, I. P. B. Knudsen 847,009
Chain, drive, W. M. Butler.......... 847,235
Chain link, E. H. Mills 846,803
Chair, G. E. Crump 846,910
Chalk trough, C. A. Hess.......... 846,667
Cheese cutters, cheese guard and support for, Van Deventer & Swank.......... 846,634
Chimney cowl, W. R. A. Ball.......... 846,446
Chuck, J. Hodson 847,251
Chuck mechanism, A. Tindel 846,875
Churn, D. L. Stewart 846,872
Cigar cutter, J. E. Ellis 846,650
Cigar cutter and nail clipper, combined, G. Havell 846,743
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Clock, electrically actuated, R. W. Smedberg 846,515
Closet bowls, waste pipe connection for, H. J. Luff 846,929
Cloth cutting machine, C. L. Bryan....... 846,777
Clothes clamp, T. W. De Laughter......... 847,046
Clothes pin, S. Pasqualin.......... 847,106
Cluster socket, J. H. Dale.......... 846,912
Clutch, friction, Erickson & Nystrom...... 846,654
Clutch mechanism, J. & F. Doepker........ 846,733
Coal, coking, S. B. Sheldon.......... 846,958
Coal dust for making metallurgical coke or other kinds of coke, utilizing close burning, J. de Veina.......... 847,134
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Cock for flush tanks, ball, J. McKaig..... 846,598
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Coffee pot, G. F. W. Holman.......... 846,473
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Collar and hame, combined horse, J. Martin 847,090
Collar, horse, H. A. Fonteine.......... 847,248
Column, wooden, H. Brown 846,450
Commutator, J. R. Grindrod 847,284
Concrete bridge, G. Glascock.......... 846,659
Condenser, jet, E. Koerting 847,010
Contact for third rail systems, interrupted, Katzman & Vizethann 847,080
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Cooking apparatus, steam, W. C. Salmon.. 847,117
Cooking utensil, H. R. Barnard.......... 847,225
Cop tube, E. H. Guerin.......... 847,177
Copper, extracting, O. Frolich.......... 846,657
Copper refining furnace, R. Baggaley.... 846,891
Cork puller, G. Sparano.......... 847,124
Cotton cleaner and distributer, J. Clem, Jr. 847,162
Coupling, E. H. Gold.......... 846,994
Cracker box, J. H. Byrne.......... 846,452
Crane, traveling, A. E. Evans.......... 846,837
Cultivator, H. M. Toepfer.......... 846,876
Cultivator, A. Nolf 847,101
Cultivator, L. Parenti.......... 847,258
Cultivator, adjustable, W. Wolf.......... 847,142
Cupola furnace, B. D. McCormick.......... 847,097
Curling irons, hair waving attachment for, A. Weller 846,813
Current demands, system for the supply of, F. W. Springer 846,703
Current motor, alternating, E. J. Berg.... 847,153
Cutter head knives, radial setting gage for, C. W. H. Blood 846,723
Damper actuating device for ranges, etc., I. Brooke 846,821
Damper, chimney, A. E. Albertson......... 846,542
Decorating kiln, continuous, J. Gamble.... 846,559
Die head, W. A. Kerr.......... 847,186
Dirt carrier, J. H. Moragne.......... 847,199
Dish washing machine, R. H. Sunkle...... 847,129
Disinfectants to water closets, apparatus for applying, A. D. Easton 846,831
Display outfit, Newman & Bothwell....... 846,690
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Displaying form, wearing apparel, Edwards & Dunbar.......... 846,833
Door check, J. L. Ridgway 847,113
Door check, M. L. Harris 847,285
Dough raiser, F. McDonald.......... 847,020
Dough shaping machine, H. F. W. Hueg... 846,790
Drainage trap, antisiphon, D. Whiteford.. 846,537
Drawer pull, F. X. Ammann 846,441
Drawing board attachment, G. R. Evans... 846,987
Drying machine, E. B. Ayres.......... 847,038
Drill brace, T. Kuhn 847,013
Drilling machine, F. M. Stambaugh........ 847,297
Drink mixer, C. G. Miller 846,931
Drum, heating, F. J. Kobusch.......... 847,256
Dumping and distributing apparatus, A. Moore 846,596
Dust collecting system, W. E. Allington.... 846,973
Dye, ortho-oxy-monoazo, W. Schumacher... 846,511
Dyeing apparatus, P. Fontaine.......... 846,462
Dyeing apparatus, H. Pattyn.......... 846,940
Egg beater, E. R. Godward 846,662
Egg beater, A. J. Thompson.......... 846,763
Egg beater, S. Danner.......... 846,829
Egg beater, whisk, etc., E. R. Godward... 846,661
Electric circuits, shunt for, M. J. Wohl... 846,969
Electric circuits, thermal cut-out for, G. E. Painter 846,691
Electric controller, F. Volk 846,533
Electric furnace, L. W. Stevens.......... 846,521
Electric furnace, B. von Ischewsky........ 847,003
Electric heater, A. H. Bremer et al....... 846,544
Electric heater, J. T. Howell.......... 846,853
Electric light hanger, F. E. Christman.... 846,778
Electric meters, device to disclose opening of the shunt circuits of, W. L. Saunders 846,624
Electric motor controller, F. Schaefer..... 846,626
Electric motor, variable speed, J. C. Lincoln 847,088
Electric switch, H. Sawyer 846,625
Electric switch, A. Koesche 846,673
Electric switch, I. Kitsee 847,007
Electric switch, G. W. Liden.......... 847,087
Electric system, high tension direct current, J. S. Highfield 846,566
Electrical apparatus, high pressure, E. J. Koch 846,672
Electrical conductor, F. Platt.......... 847,303
Electrically heated body, E. Haagn....... 847,065
Electromagnetic transmitting device, M. Johannet 847,079
Elevator. See Portable elevator.
Elevator safety device, C. R. Pratt...... 846,613
Elevator safety device, G. R. Layman..... 847,083
Engine ignition apparatus, explosion, H. C. Royer 847,293
Engine ignition system, explosion, R. Varley 846,811
Engine reversing mechanism, explosive, L. M. J. C. Levavasseur 846,487
Engine spark ignition system, explosion, Varley & Scott 846,809
Engine starting crank, explosion, A. Schluter 846,698
Engines, feed governor for oil, F. G. Hobart 846,471
Envelope, F. Klousnitzer.......... 846,478
Envelope, C. Panek 846,504
Envelope, L. B. Myers 847,098
Envelope and letter sheet, combined, A. J. Farmer 846,983
Eraser cleaner, blackboard, H. Meyer.... 846,681
Excavating wheeler, F. F. Furlough....... 847,057
Excavator, J. E. Kennedy.......... 846,791
Explosion engine, S. A. Reeve.......... 846,508
Fabric tufting machine, J. J. Baird....... 846,717
Fabrics, machine for producing ornamental surfaces on fleeced, C. H. French...... 847,056
Fan hanger, M. E. McBee.......... 847,096
Farm implement, motor driven, M. O. Sandberg 847,026
Fastener, A. F. Randall 847,295
Fastening device, M. L. Martinez 846,678
Fastening, separable, W. B. Murphy...... 847,291
Faucet, J. W. Horth.......... 846,920
Faucets, cut-off for, J. W. Collins.......... 846,780
Feed bag, G. P. Drueck, Jr.......... 846,985
Feed gage, L. E. Tait.......... 846,630
Fence post, cement, S. Landes.......... 846,798
Fence post, metal, O. A. Wilson.......... 847,141
Fender, J. R. Plank.......... 847,108
Fertilizer distributer, C. B. Rozar.......... 846,623
Fiber vessel, J. J. Shea, reissue.......... 12,616
Filaments of metamorphosed cellulose, etc., apparatus for forming, M. Waddell.... 846,879
File, bill, E. Plourde.......... 846,946
File cabinet, S. T. Walton.......... 846,881
Filter, H. Lieberich 846,582
Filter, A. Kiell 846,748
Filter, M. G. Melvin 846,859
Filter, water, O. Watson 846,882
Filtering apparatus, M. N. Otto.......... 847,103
Fire alarm system, J. G. Nolen.......... 846,592
Fire alarm system, M. Connor.......... 846,729
Fire apparatus, H. W. Eisenbise.......... 846,835
Fire kindling, composition of matter for, Daley & Johnson 846,554
Firearm, Kolb & Foehl.......... 847,011
Firearm, automatic, W. Mason.......... 846,591
Firearm sight, G. S. Wilcox.......... 846,637
Firearm sight, J. Windridge 846,638, 846,639
Fireproof shutter, P. O'Reilly.......... 846,603
Fireproof window construction, W. H. Miller 846,682
Fish holder, live, C. J. Remsburg.......... 846,861
Fish trap, E. F. Dollar.......... 846,556
Fishing rod attachment, C. L. Sullivan.... 847,298
Fishing tool, C. E. Downs.......... 847,168
Floor cleaning device, Wallace & Harhager 847,138
Floor set, A. Ayers 847,272
Flue dust, recovering values from, R. Baggaley 846,818
Fluid check device, J. C. Phipps.......... 846,943
Fluid operating machines, plunger cleaning means for, W. T. Sears.......... 847,119
Fluid pressure plunger, E. H. Mumford... 846,985
Flume gate, A. E. Chapman.......... 847,160
Folding stand, automatic, Collins & Browning 846,553
Freezing of water hydrants, means for the prevention of, J. Pye.......... 847,204
Fruit clipper, T. H. Deshane.......... 846,732
Funnel, automatic, E. R. Kern.......... 847,081
Furnaces, drying air for blast, N. T. Bacon 847,273
Gage, Glass & Muther.......... 846,660
Gage, C. A. Good.......... 847,176
Game apparatus, E. H. Richter.......... 846,509
Game apparatus, T. J. Falvey.......... 846,655
Garment fastener, J. H. White.......... 847,217
Garment hanger, J. M. Stein........847,211, 847,212
Garment support, G. E. Crump.......... 846,911
Garment, supporting, B. M. Grayson........ 846,562
Gas burner, A. J. Meyers.......... 846,930
Gas burner, Springer & Maloney.......... 847,210
Gas engine, H. B. Benjamin.......... 846,897
Gas machine, Mason & Sinclair.......... 846,680
Gas manufacture, apparatus for, F. Logan. 846,489
Gas plant, producer, P. Eyermann.......... 847,054
Gas regulator and cut-off, automatic, Partis & Rowland 846,947
Gases, apparatus for removing impurities from furnace, R. Baggaley.......... 846,816
Gear cutting machine, J. Parker.......... 846,505
Gearing, A. Gerber 846,465
Gearing, change, A. H. Ehle 847,048
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Glass drawing and blowing apparatus, H. G. Slingluff 847,027
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Glove retaining device, E. O. De Vries..... 846,914
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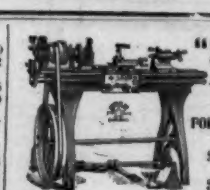
Grave filler, W. S. Pendleton.......... 846,757
Grinding machine, Muncaster & Fletcher.. 846,496
Grits and dust purifier, C. Jaquet.......... 846,670
Gun, magazine, J. Lauber.......... 846,576
Gun rack, R. B. Lamb.......... 846,674
Gymnastic performances, means for producing aerial, J. J. Williams.......... 847,130
Hame, J. F. Hopfner.......... 846,745
Hammer, W. McDougall 846,687
Harness attachment, A. W. Burnett........ 846,822
Harrow, J. F. Williams.......... 847,036
Harrow, W. B. Essick.......... 847,051
Harrow, A. D. Harris.......... 847,068
Harvester attachment, L. Franzmeier....... 846,918
Hat and coat rack, locking, J. E. Dundore. 846,460
Hat pin, G. N. Steere.......... 846,518
Hat retaining device, S. Rosenthal........ 846,953
Hay, grain, etc., covering for, P. Schoenle 846,627
Hay rake, J. Dain 846,456
Hay rake, J. W. Hurd.......... 847,074
Heater, M. F. W. Pliske.......... 846,611
Heating boiler, C. L. Holden.......... 846,472
Heating device, T. Sharp.......... 847,121
Heating furnace, continuous, Parrock & McKee 846,506
Hemmers, folder attachment for, E. F. Gibbons 846,742
Hide carroting machine, C. & E. Pichard... 846,944
Hinge and fastening for doors, combined, A. Abzug 847,145
Hitch, horse, E. J. Aitken.......... 846,715
Hoisting apparatus safety arrangement, W. Thornber 846,807
Holder for domestic articles, M. Pike...... 846,758
Hook and eye, H. Atkinson.......... 847,271
Hook switch, C. T. Mason.......... 846,590
Horse blanket, F. H. Vinton.......... 846,812
Hose coupling, J. Berk 847,042
Hose coupling, J. F. McElroy.......... 847,202
Hose rack, C. Wright 846,713
Hot air register, J. W. Ratz.......... 846,616
Hot blast, water coil, and gas burner, combined, J. B. Ehrlich 846,916
Hot water regulator, G. Parge.......... 847,104
Hydraulic separator, J. Curatolo 846,649
Ice pick, B. A. Grasberger.......... 846,843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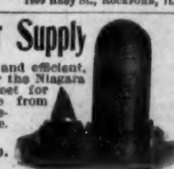

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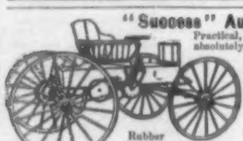

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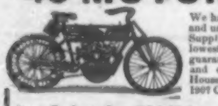

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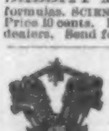

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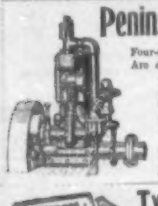

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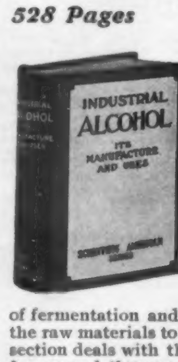

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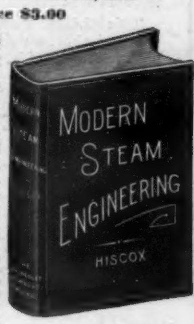

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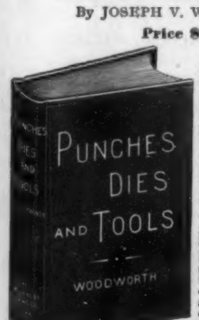

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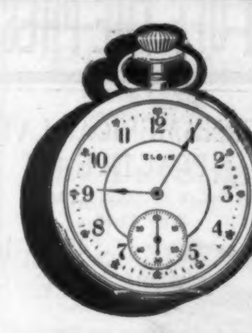

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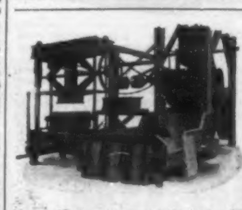

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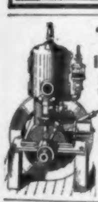

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Soap, Mexican Amole Soap Co. 61,304, 61,305
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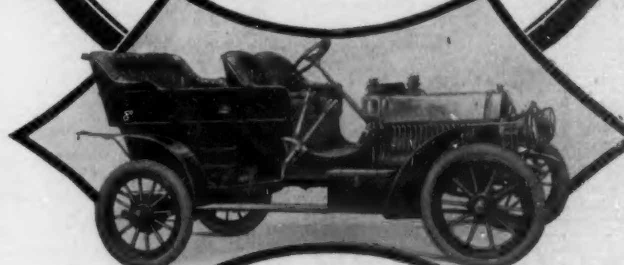

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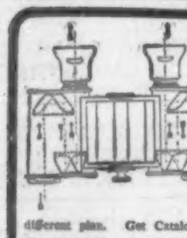

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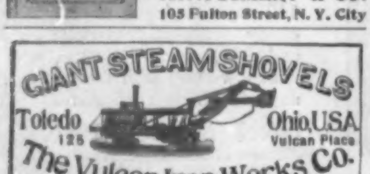

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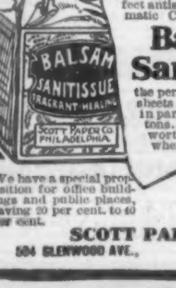

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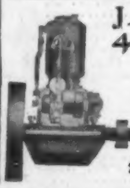

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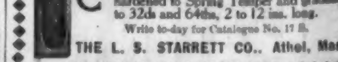

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